航 海 仪 器 实 验 指 导 书

Experiment Instruction Handbook in Support of the Subject of Shipborne Navigational Aids including Gyrocompass, Echosounder, Speedlog and Magnetic Compass

Contents

I Gyrocompass 1
1 STD 22 1
1.1System overview 1
1.2 Technical data 2
1.3 Operation 3
1.4 Maintenance 15
2 SGB Brown Meridian 16
2.1System overview 16
2.2 Technical data 17
2.3 Operation 19
2.4 Maintenance 28
3 NAVIGAT X MK 1 40
3.1 System overview 40
3.2 Technical data 41
3.3 Operation 43
3.4 Maintenance 48
4 TG-6000 62
4.1 System overview 62
4.2 Technical data 62
4.3 Operation 65
4.4 Maintenance 78
II Magnetic compass 82
1 NAVPOL I 82
1.1 System overview 82
1.2 Technical data 83
1.3 Operation 84
1.4 Maintenance 84
III Echosounder 85
1 DEBEG 4630 85
1.1 System overview 85
1.2 Technical data 86
1.3 Operation 89
1.4 Maintenance 127
2 GDS101 130
2.1 System overview 130
2.2 Technical data 135
2.3 Operation 137
2.4 Maintenance 152
3 FE700 158
3.1 System overview 158

3.2 Technical data....163
3.3 Operation....172
3.4 Maintenance....198
IV Speedlog....204
1 EML224....204
1.1 System overview....204
1.2 Technical data....204
1.3 Operation....206
1.4 Maintenance....226
2 DS80....228
2.1 System overview....228
2.2 Technical data....229
2.3 Operation....232
2.4 Maintenance....246

I Gyrocompass

1 STD 22

1.1System overview

This compass is designed for use as a navigation aid on board ships.
As a sensor, and unaffected by the magnetic earth field, it determines the north bearing, and thus enables a course to be steered in relation to true north.
This compass provides course information and status signals to those responsible for course setting.
In principle we can distinguish between two different applications for the compass:
The STD22 Compact Compass as a stand--alone system
andThe STD 22 Compass used in conjunction with other system components such as a magnetic compass, GPS or other STD 22 gyro compasses. An Operator Unit and a Distribution Unit are required to connect and to operate these system components.
The overview below illustrates the functional differences between these two versions.

STD 22 Compact as a stand-alone system	STD 22 with other system components (Distribution Unit and Operator Unit)
Inputs: -- GPS positioning data -- Speed data from the GPS -- Speed from the Pulse Log -- Direction of speed from the Pulse Log -- NMEA -- 24V d.c. voltage supply	Inputs (via the Distribution Unit only through a ”CAN bus” data bus system): -- GPS positioning data -- Speed data from the GPS -- Speed from the Pulse Log -- Leading sign for the speed from the Pulse Log -- NMEA -- 24V d.c. voltage supply -- DV--bus (no inputs for speed/position at the Distribution Unit Optional feature: -- Magnetic sonde can be connected
Outputs: -- 2 x Heading (course bus or NMEA) designated CHn 1 and CHn 2	Outputs (at STD 22 compass): -- 2 x Heading (course bus or NMEA) -- 1 x Heading (course bus) -- Status signals

-- 1 x Heading (course bus) -- Status signals SEC (speed error correction) System Available Optional feature Additional Output Box 146--103 Input: -- 1 x Heading (course bus) Outputs: SSC--Interface Step (6 steps/degree) NMEA 0183 superfast 50Hz	SEC(speed error correction) System Available ⚠ Heading (Course bus or NMEA) without SEC Outputs (to the Distribution Unit): -- 1x RS232 for courseprinter -- 1x rate of turn -- 3 x Step (6 steps/degree) -- 8 x Heading (course bus or NMEA) 12x for version E10 -- DV--bus -- Status signals
Functions: -- Integral Speed Error Correction (SEC) Optional feature -- Quick Settling with the Operator Unit for Quick Settling	Functions: (Compass STD 22) -- Integral Speed Error Correction (SEC) -- Quick Settling via the operator unit

1.2 Technical data

The technical data stated here apply equally to the STD 22 Compact Gyro Compass and the STD 22 Gyro Compass

1.2.1 Mechanical data

Gyro compass:
Height: approx. 429 mm
Diameter: approx. 414 mm
Weight approx. 16 kg
Type of enclosure: IP23

1.2.2 Electrical data

Gyro compass
Supply voltage: 18--36 V d.c.

Current consumption: maximum approx. 5A (heating stage)

1.2.3 General Technical Data

"Quick Settling" function
Reduces the settling in phase to approximately 1 hour.
Quick Settling should only be used when the heading of the vessel has not been changed during the period between switching off the compass and switching it back on and if the compass has been switched off for a duration of min. 1 hour before.
Speed Error Correction
Automatic correction of a course, related to speed and degree of latitude
Pulse log input (200 Pulses/Nm)
Pulse log -- Direction -- input (+) → "Speed ahead"
(-) → "Speed astern"
or "reverse speed" status
GPS input (NMEA 0183)
Log input (NMEA 0183)
Indicator precision

1.2.4 Gigit digital display

Resolution 0.1°.
Heading accuracy
Settle point error: ± 0.1° x secLAT., RMS
Static error:±0.1° x secLAT., RMS
Dynamic error ± 0.4° x secLAT., RMS
(periodic roll and pitch + horizontal acceleration)
secLat. = 1/cosLatitude

1.3 Operation

1.3.1Quick Settling operator unit

The "Quick Settling" function reduces the time the compass requires to settle to approximately one hour.
The most recent heading is stored when the gyro compass is switched off. When it is switched on the compass uses that value to make a default setting so that the settling time is reduced.

The Quick Settling function can only be used if the ship

heading has not been changed between switching off and switching on again and the compass has been switched off for a duration of min. 1 hour.
Furthermore this Qick Settling function cannot be used after first installation.

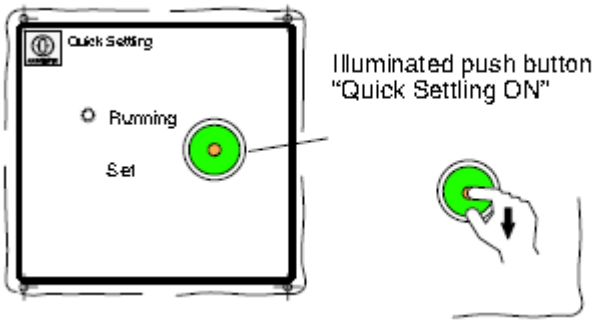


Figure 3 : Controls and indicators on the Quick Settling Control Unit
The "Quick Settling ON" button → activates this function.
→ Flashes if it is possible to activate this function.It flashes for maximum 3 minutes.
→ Illuminates if the Quick Settling function is active.
Installation and assembly instructions are in the Service section of this manual.

1.3.2 Controls and Indicators on the Gyro Compass

The user information stated here applies equally to the STD 22 Compact Gyro Compass and the STD 22 Gyro Compass.

Viewed from above (see Figure 8)
-- Digital indication of the following:
Compass course
Operating status
Warnings
Error messages

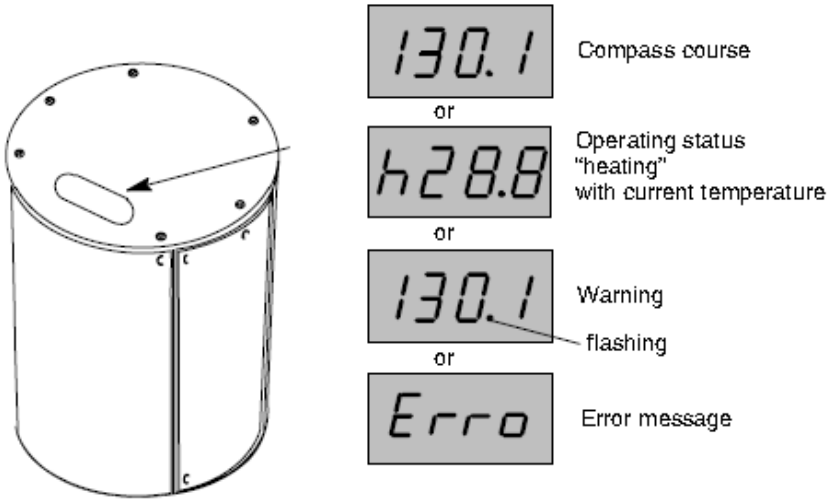


Figure 8 : The indicators on the gyro compass with examples of the type of indication

After removing the cover:

⚠	Do not touch live parts. Neither the DIP switches nor the buttons are

A DIP switch (B37) and two push--buttons (B38 and B39) are used to adjust the settings as follows:

-- Course and correction data

-- Settings for functional checks

-- System settings such as data formats or transmission speeds.

Only authorised personnel are authorised to change system settings!!

Please observe the relevant instructions in the service manual.

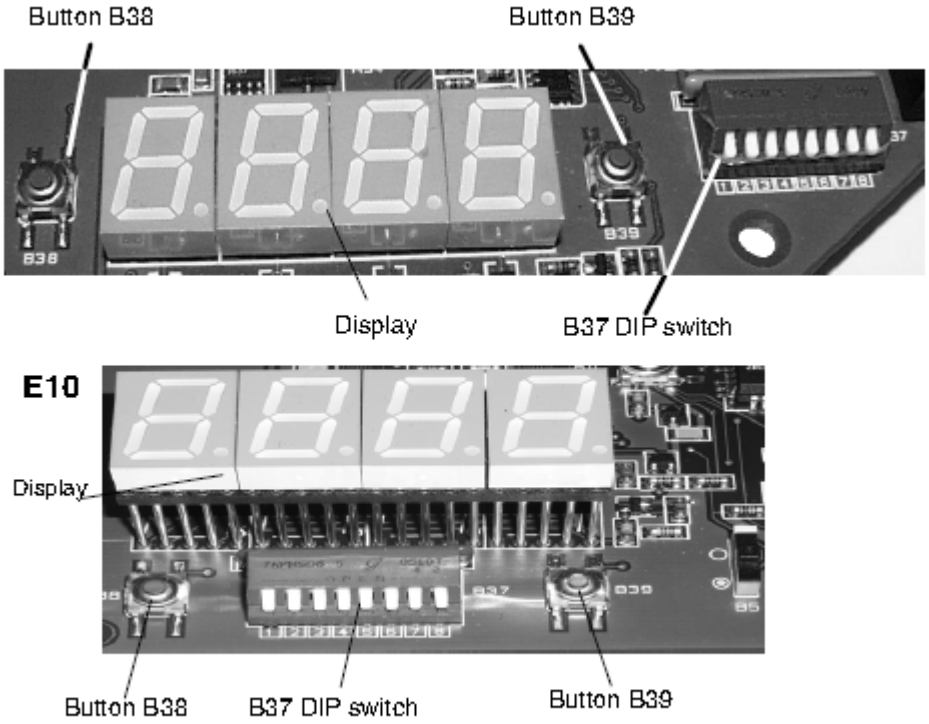


Figure 9 : Operating elements on the compass (after removing the cover)

1.3.3 Switching on the STD 22 Compass

The compass goes into operation when the power supply is switched on from the ship’s mains.

The compass goes into the heating stage for the first 30 minutes (this period will vary depending on the temperature of the supporting liquid) and the letter “h” is displayed as the leading sign on the digital display. The follow-up system is switched off -- no course can be output.

When the temperature of the supporting liquid reaches 45 °C the follow-up system switches on automatically, and the course is displayed on the compass; however deviation from actual course may still be considerable.

This settling in phase (indicated by an additional dot on the digital display) ends 4 hours after switching on. Accuracy is now < 2°

After about five hours (from switching on) the compass shows an accurate heading

The “Quick Settling” option reduces the settling in phase to one hour. With it, precision (after one hour) is better than +/-3°.

3.3.1 Indications on the compass during the heating stage

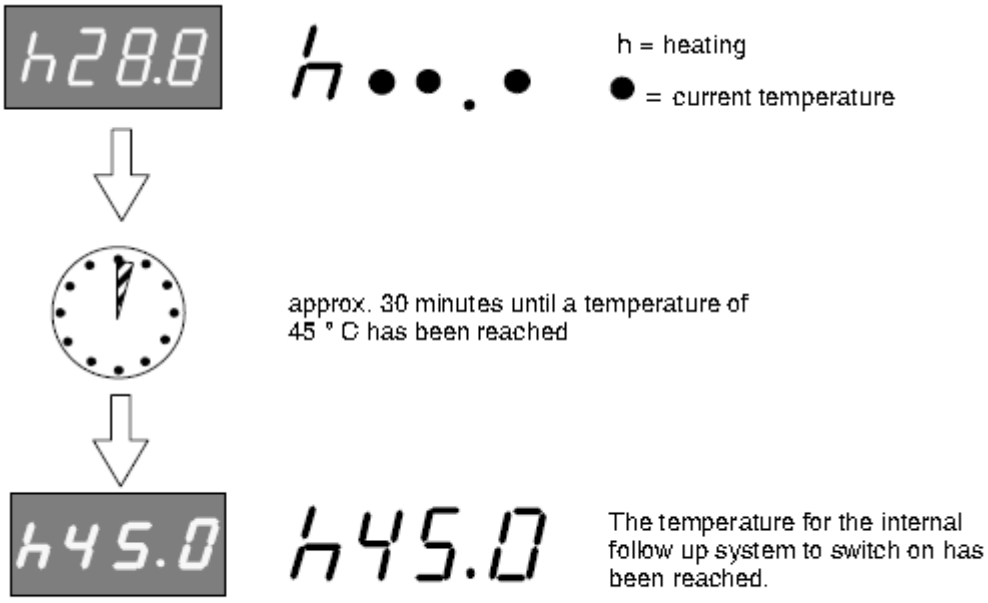
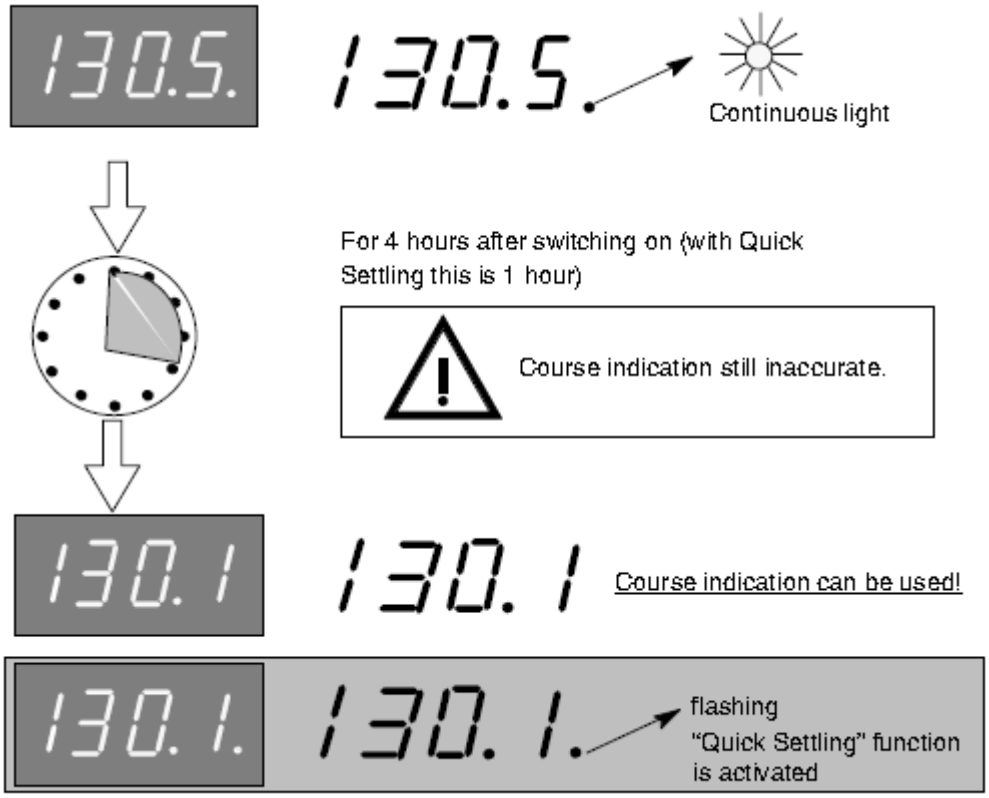


Figure 10 : Indications during the heating stage

3.3.2 Indications on the compass during the settling in stage



Note: If the Quick settling function is activated, the heading to which it will followed—up is displayed.

Figure 11 : Indications during the settling stage

3.3.3 Overview of indications (digital display) during operation

Once the compass is switched on the digital display indicates as follows:

Indications	Comments, Information
① Heating stage	
Example	The temperature of the supporting liquid is displayed during the heating stage. Example: h 28.8 = 28.8 °C heating stage
② Settling stage	
Example lit up	The gyro compass is settling in. -- The course is indicated with an illuminated dot after the last figure during the settling stage (approx. 4 hours) The course value is still not accurate!
③ Course indication	
Example	Once the settling process has ended: Course accuracy: -- 4 hours after switching on is better than 2° or -- with Quick-Settling 1 hour after switching on is better than 3° -- Approximately 5 hours after switching on0.4° dynamic, 0.1° static

1.3.4 Heading correction

The information given here, in particular with regard to Speed Error Correction, applies in general to the STD 22 Compact compass and the STD 22 compass. Where there is an exception, your attention is drawn to this.

The heading has to be corrected::
-- a correction depending on the alignment error
-- a correction depending on a speed error

3,4.1 Alignment error

The alignment error (A-error) occurs if the compass was not correctly aligned when it was installed, i.e. when the compass zero line does not agree with the ship’s--line pre-alignment. An alignment error can be corrected at max. 5 h after switching on and/or max. 5 h when the ship is moored by making readjustments (see also service manual).

To try to perform a readjustment within this 5 hours, will lead to a displayed message “AL.no” after pressing the buttom B38 or B39 (it means: actually no readjustment possible).

1.3.4.1Procedure for setting the compass zero (A-error)

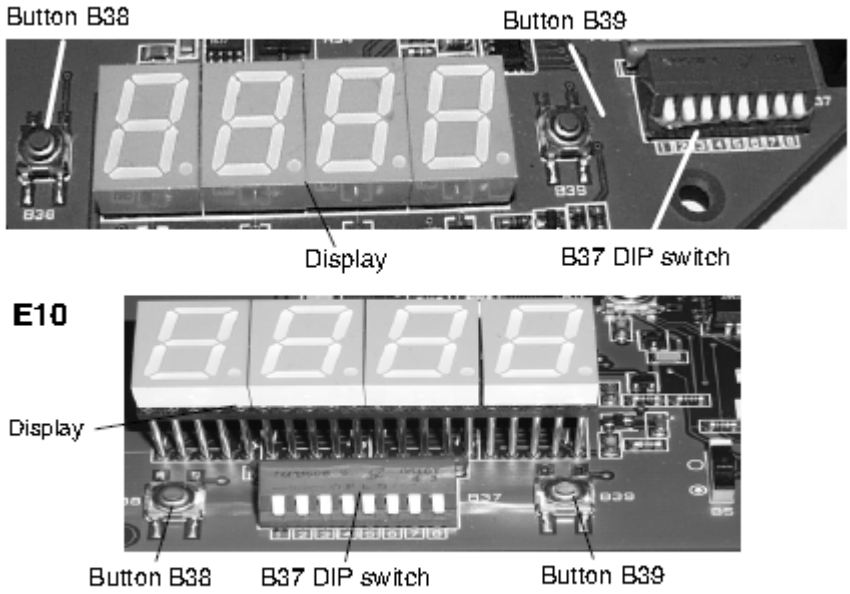


Figure 12 : Arrangement of operating elements inside the compass

1.) Remove the cover of the compass (unfasten the 5 cross--slotted screws)
2.) Move switch B37 (DIP switch), contact (1) to the “OPEN” position.
3.) The digital indicator is now indicating “ALEr” = Alignment Error
4.) Press button B38 or B39 until the heading you require displays.
As you do so the course value changes (B38 changes the value downwards and B39 changes it upwards).
If you hold down the button the speed at which it changes will increase.
NOTE: If the message “AL.no” is displayed, then the a. m. restriction of 5 hours is not over.
5.) Move switch B37 (DIP switch), contact (1) back to the “OFF” position.

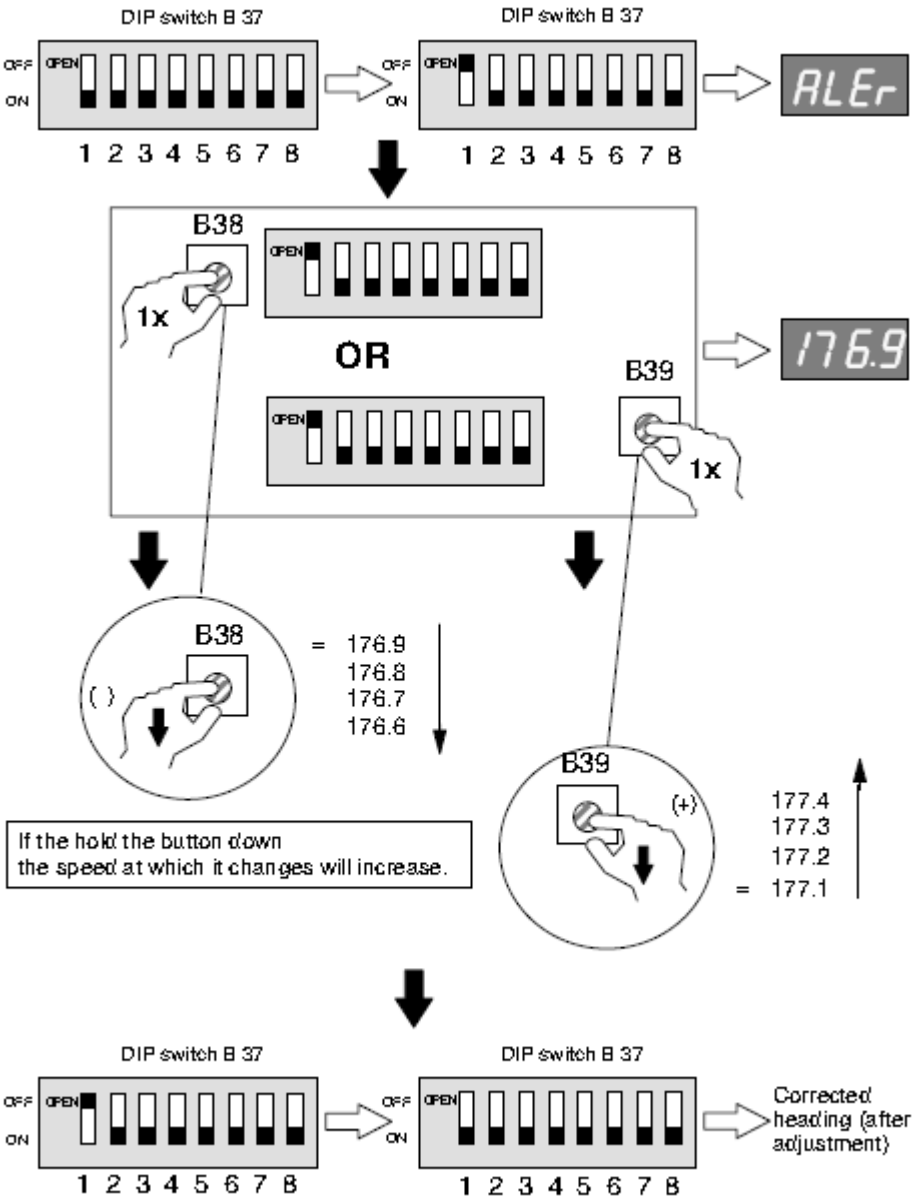


Figure 13: Procedure for setting compass zero

1.3.4.2 Speed error

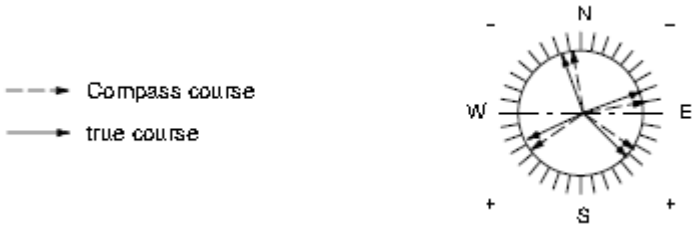
A speed error occurs while the ship is travelling. This becomes greater as the speed increases and is more pronounced on northerly and southerly courses than on easterly and westerly courses.
Speed error is a physical deviation from the steering course indicated on the gyro compass (compass course) from the true course (chart course). It depends on the speed of the ship, the course it is steering and the latitude.
The speed error is typically within the range of 0° --2° , and with fast ships, it can even reach 5° or more.
With automatic speed error correction the compass course is continually corrected

using the values shown in the speed error table (see section 2.2.2.1). The digital display on the compass and the connected repeater displays will always indicate the true (corrected) course.
For automatic speed error correction the ship’s speed and the latitude are read into the gyro compass.
The speed error correction function on the STD22 Compact Gyro Compass
Only the automatic speed error correction function applies; in order for it to operate GPS or Pulse Log and GPS data (speed and degree of latitude) must be supplied to the compass.
CAUTION: If the speed and latitude are not available for automatic speed error correction (Pulse Log or GPS failure), no automatic correction can take place. The gyro compass will be showing the uncorrected value.
The speed error correction function on the STD22 Gyro Compass
In this version, besides the automatic speed error correction function (with GPS and Pulse Log data) the speed error correction function can also be carried out (with manual speed and latitude values input) manually. The speed error can be corrected manually on the Operator unit by entering the speed and latitude manually (see also Manual no.3648 “Operator Unit 130-613”)
Add the correction value taken from the table to the uncorrected course (making sure you note the leading sign).

Example of course calculation	1	2
Compass course	345°	223.7°
Latitude	55°	55°
Speed	16 Kts	16 Kts
Correction value from table	1.7°	+ 1.3°
True course	345° -1.7° = 343,3°	223.7° + 1.3° = 225°

Example of a bearing:
Compass course 255°
Latitude: 55°
Speed: 16 Kts
Direction of bearing: 135°
Correction value as per table: +0.5°
True bearing: 135° + 0.5° = 135.5°

The following statement applies:
The TRUE COURSE is always to the west of the compass course.



3.4.2.1 Speed error table

Latitude in °	north		south		Speed in Kts										
	Courses in ° sign for correction value														
	-		+		4	8	12	16	20	24	28	32	36	40	44
0 to 20	0	360	180	180	0.3	0.5	0.8	1.0	1.3	1.5	1.8	2.1	2.4	2.6	2.9
	15	345	165	195	0.3	0.5	0.8	1.0	1.3	1.4	1.7	2.0	2.3	2.5	2.8
	30	330	150	210	0.2	0.4	0.6	0.9	1.1	1.3	1.5	1.8	2.0	2.3	2.5
	45	315	135	225	0.2	0.4	0.5	0.7	0.9	1.1	1.3	1.5	1.7	1.9	2.1
	60	300	120	240	0.1	0.3	0.4	0.5	0.7	0.8	0.9	1.1	1.2	1.3	1.4
	75	285	105	255	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.8
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
30	0	360	180	180	0.3	0.6	0.9	1.2	1.5	1.7	2.0	2.3	2.6	2.9	3.2
	15	345	165	195	0.3	0.6	0.9	1.1	1.4	1.6	1.9	2.3	2.6	2.8	3.1
	30	330	150	210	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.3	2.5	2.8
	45	315	135	225	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.7	1.9	2.1	2.3
	60	300	120	240	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.3	1.5	1.6
	75	285	105	255	0.1	0.2	0.3	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.8
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
40	0	360	180	180	0.3	0.7	1.0	1.3	1.7	2.0	2.3	2.7	3.0	3.3	3.7
	15	345	165	195	0.3	0.7	1.0	1.2	1.5	1.9	2.2	2.6	2.9	3.2	3.5
	30	330	150	210	0.3	0.6	0.8	1.1	1.4	1.7	2.0	2.3	2.6	2.9	3.2
	45	315	135	225	0.2	0.4	0.7	0.9	1.2	1.4	1.6	1.9	2.1	2.4	2.6
	60	300	120	240	0.2	0.3	0.6	0.7	0.9	1.0	1.2	1.3	1.5	1.7	1.8
	75	285	105	255	0.1	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.9
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
45	0	360	180	180	0.4	0.7	1.1	1.4	1.8	2.2	2.5	2.9	3.2	3.6	4.0
	15	345	165	195	0.3	0.7	1.0	1.4	1.7	2.1	2.4	2.8	3.1	3.5	3.8
	30	330	150	210	0.3	0.6	0.9	1.2	1.6	1.9	2.2	2.5	2.8	3.1	3.4
	45	315	135	225	0.3	0.5	0.8	1.0	1.2	1.5	1.8	2.0	2.3	2.5	2.8
	60	300	120	240	0.2	0.4	0.5	0.7	0.9	1.1	1.3	1.4	1.6	1.8	2.0
	75	285	105	255	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.9	1.0
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
50	0	360	180	180	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.3
	15	345	165	195	0.4	0.8	1.1	1.5	1.8	2.2	2.6	3.1	3.4	3.8	4.2
	30	330	150	210	0.3	0.7	1.0	1.3	1.6	2.0	2.3	2.7	3.1	3.4	3.8
	45	315	135	225	0.3	0.6	0.8	1.1	1.4	1.7	2.0	2.2	2.5	2.8	3.1
	60	300	120	240	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2
	75	285	105	255	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0

Latitude in °	north		south		Speed in Kts										
	Courses in ° sign for correction value														
	-		+		48	52	56	60	64	68	72				
0 to 20	0	360	180	180	3.1	3,4	3,7	3,9	4,2	4,4	4,9				
	15	345	165	195	3,0	3,3	3,5	3,8	4,0	4,3	4,7				
	30	330	150	210	2,7	3,0	3,2	3,4	3,6	3,8	4,2				
	45	315	135	225	2,2	2,4	2,6	2,8	3,0	3,1	4,3				
	60	300	120	240	1,6	1,7	1,8	2,0	2,1	2,2	2,4				
	75	285	105	255	0,8	0,9	1,0	1,0	1,1	1,2	1,3				
	90	270	90	270	0	0	0	0	0	0	0				
30	0	360	180	180	3,5	3,8	4,1	4,4	4,7	5,5	5,3				
	15	345	165	195	3,4	3,7	4,0	4,3	4,5	4,8	5,1				
	30	330	150	210	3,0	3,3	3,6	3,8	4,1	4,3	4,6				
	45	315	135	225	2,5	2,7	2,9	3,1	3,3	3,5	3,7				
	60	300	120	240	1,8	1,9	2,1	2,2	2,3	2,5	2,6				
	75	285	105	255	0,9	1,0	1,1	1,1	1,2	1,3	1,4				
	90	270	90	270	0	0	0	0	0	0	0				
40	0	360	180	180	4,0	4,3	4,6	5,0	5,3	5,6	6,0				
	15	345	165	195	3,8	4,2	4,5	4,8	5,1	5,5	5,8				
	30	330	150	210	3,5	3,7	4,0	4,3	4,6	4,9	5,2				
	45	315	135	225	2,8	3,1	3,3	3,5	3,6	4,0	4,2				
	60	300	120	240	2,0	2,2	2,3	2,5	2,7	2,8	3,0				
	75	285	105	255	1,0	1,1	1,2	1,3	1,4	1,5	1,5				
	90	270	90	270	0	0	0	0	0	0	0				
45	0	360	180	180	4,3	4,7	5,0	5,4	5,8	6,1	6,5				
	15	345	165	195	4,2	4,5	4,9	5,2	5,6	5,9	6,3				
	30	330	150	210	3,8	4,0	4,4	4,7	5,0	5,3	5,6				
	45	315	135	225	3,1	3,3	3,6	3,8	4,1	4,3	4,6				
	60	300	120	240	2,2	2,3	2,5	2,7	2,9	3,1	3,2				
	75	285	105	255	1,1	1,2	1,3	1,4	1,5	1,6	1,7				
	90	270	90	270	0	0	0	0	0	0	0				
50	0	360	180	180	4,8	5,1	5,5	5,9	6,3	6,7	7,1				
	15	345	165	195	4,6	5,0	5,4	5,7	6,1	6,5	6,9				
	30	330	150	210	4,1	4,5	4,8	5,1	5,5	5,8	6,2				
	45	315	135	225	3,4	3,6	3,9	4,2	4,5	4,8	5,0				
	60	300	120	240	2,4	2,6	2,8	3,0	3,2	3,4	3,6				
	75	285	105	255	1,2	1,3	1,4	1,5	1,6	1,7	1,8				
	90	270	90	270	0	0	0	0	0	0	0				

Latitude in °	north		south		Speed in Kts										
	Courses in ° sign for correction value														
	-		+		4	8	12	16	20	24	28	32	36	40	44
	0	360	180	180	0.4	0.9	1.3	1.8	2.2	2.7	3.1	3.6	4.0	4.4	4.9
	15	345	165	195	0.4	0.9	1.3	1.7	2.1	2.6	3.0	3.4	3.9	4.3	4.7
	30	330	150	210	0.4	0.8	1.1	1.5	1.9	2.3	2.7	3.1	3.5	3.8	4.2
55	45	315	135	225	0.3	0.6	0.9	1.3	1.6	1.9	2.2	2.5	2.8	3.1	3.5
	60	300	120	240	0.2	0.4	0.7	0.9	1.1	1.3	1.6	1.8	2.0	2.2	2.4
	75	285	105	255	0.1	0.2	0.3	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.3
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
	0	360	180	180	0.5	1.0	1.5	2.0	2.5	3.1	3.6	4.1	4.6	5.1	5.6
	15	345	165	195	0.5	0.9	1.4	1.9	2.4	2.9	3.4	3.9	4.4	4.9	5.4
	30	330	150	210	0.4	0.8	1.3	1.7	2.1	2.6	3.1	3.5	4.0	4.4	4.9
60	45	315	135	225	0.4	0.7	1.1	1.4	1.8	2.2	2.5	2.9	3.2	3.6	4.0
	60	300	120	240	0.3	0.5	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5	2.8
	75	285	105	255	0.2	0.3	0.4	0.6	0.7	0.8	0.9	1.1	1.2	1.3	1.5
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
	0	360	180	180	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.7
	15	345	165	195	0.6	1.2	1.7	2.3	2.9	3.5	4.1	4.7	5.2	5.8	6.4
	30	330	150	210	0.5	1.0	1.6	2.1	2.6	3.1	3.6	4.2	4.7	5.2	5.7
65	45	315	135	225	0.4	0.9	1.3	1.7	2.1	2.6	3.0	3.4	3.8	4.3	4.7
	60	300	120	240	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3
	75	285	105	255	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	1.6	1.7
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
	0	360	180	180	0.7	1.5	2.2	3.0	3.7	4.5	5.2	6.0	6.7	7.5	8.2
	15	345	165	195	0.7	1.4	2.2	2.9	3.6	4.3	5.0	5.8	6.5	7.2	7.9
	30	330	150	210	0.6	1.3	2.0	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.1
70	45	315	135	225	0.5	1.1	1.6	2.1	2.6	3.2	3.7	4.2	4.7	5.3	5.8
	60	300	120	240	0.4	0.7	1.1	1.5	1.9	2.2	2.6	3.0	3.4	3.7	4.1
	75	285	105	255	0.2	0.4	0.6	0.8	0.9	1.2	1.4	1.5	1.7	1.9	2.1
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0
	0	360	180	180	1.0	2.0	3.0	3.9	4.9	5.9	6.9	7.9	8.9	9.9	10.9
	15	345	165	195	0.9	1.9	2.9	3.8	4.8	5.7	6.7	7.6	8.6	9.5	10.5
	30	330	150	210	0.8	1.7	2.6	3.4	4.3	5.1	6.0	6.8	7.7	8.6	9.4
75	45	315	135	225	0.7	1.4	2.1	2.8	3.5	4.2	4.9	5.6	6.3	7.0	7.7
	60	300	120	240	0.5	1.0	1.5	2.0	2.5	3.0	3.4	3.9	4.4	4.9	5.4
	75	285	105	255	0.3	0.5	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5	2.8
	90	270	90	270	0	0	0	0	0	0	0	0	0	0	0

Latitude in °	north		south		Speed in Kts										
	Courses in ° sign for correction value														
	-		+		48	52	56	60	64	68	72				
55	0	360	180	180	5,3	5,8	6,2	6,7	7,1	7,5	8,0				
	15	345	165	195	5,1	5,6	6,0	6,4	6,9	7,3	7,7				
	30	330	150	210	4,6	5,0	5,4	5,8	6,1	6,5	6,9				
	45	315	135	225	3,8	4,1	4,4	4,7	5,0	5,3	5,6				
	60	300	120	240	2,7	2,9	3,1	3,3	3,5	3,8	4,0				
	75	285	105	255	1,4	1,5	1,6	1,7	1,8	2,0	2,1				
	90	270	90	270	0	0	0	0	0	0	0				
60	0	360	180	180	6,1	6,6	7,1	7,6	8,2	8,7	9,2				
	15	345	165	195	5,9	6,4	6,9	7,4	7,9	8,4	8,9				
	30	330	150	210	5,3	5,7	6,2	6,6	7,1	7,5	7,9				
	45	315	135	225	4,3	4,7	5,0	5,4	5,8	6,1	6,5				
	60	300	120	240	3,0	3,3	3,6	3,8	4,1	4,3	4,6				
	75	285	105	255	1,6	1,7	1,8	2,0	2,1	2,2	2,4				
	90	270	90	270	0	0	0	0	0	0	0				
65	0	360	180	180	7,2	7,8	8,4	9,1	9,7	10,3	10,9				
	15	345	165	195	7,0	7,6	8,2	8,7	9,3	9,9	10,5				
	30	330	150	210	6,3	6,8	7,3	7,8	8,4	8,8	9,4				
	45	315	135	225	5,1	5,5	6,0	6,4	6,8	7,2	7,7				
	60	300	120	240	3,6	3,9	4,2	4,5	4,8	5,1	5,4				
	75	285	105	255	1,9	2,0	2,2	2,3	2,5	2,6	2,8				
	90	270	90	270	0	0	0	0	0	0	0				
70	0	360	180	180	8,9	9,7	10,5	11,2	12,0	12,7	13,5				
	15	345	165	195	8,6	9,4	10,1	10,8	11,6	12,3	13,0				
	30	330	150	210	7,7	8,4	9,0	9,7	10,3	11,0	11,7				
	45	315	135	225	6,3	6,8	7,4	7,9	8,4	9,0	9,5				
	60	300	120	240	4,5	4,8	5,2	5,6	6,0	6,3	6,7				
	75	285	105	255	2,3	2,5	2,7	2,9	3,1	3,3	3,5				
	90	270	90	270	0	0	0	0	0	0	0				
75	0	360	180	180	11,9	12,9	13,9	14,9	15,9	16,9	17,9				
	15	345	165	195	11,4	12,4	13,4	14,4	15,3	16,3	17,3				
	30	330	150	210	10,2	11,1	12,0	12,9	13,7	14,6	15,5				
	45	315	135	225	8,4	9,1	9,8	10,5	11,2	11,9	12,6				
	60	300	120	240	5,9	6,4	6,9	7,4	7,9	8,4	8,9				
	75	285	105	255	3,1	3,3	3,6	3,8	4,1	4,3	4,6				
	90	270	90	270	0	0	0	0	0	0	0				

1.4 Maintenance

Supporting liquid and distilled water have to be replaced every 18 -- 24 months. In this association the respective O--rings should be replaced as well.
A cleaning of the internal of the housing at the bottom case is practically.
Instructions for carrying out this operation and a maintenance plan (for authorized service personnel only) are given in the service manual.

2 SGB Brown Meridian

2.1System overview

The Meridian Gyrocompass is a master heading reference instrument that applies the characteristics of a dynamically tuned gyroscope and the effects of gravity and earth rotation to provide a true north reference.
The Meridian Gyrocompass specification makes the System ideal for installation and operation on board vessels of almost any size and in a wide range of applications.
Among the standard features of the Meridian Gyrocompass are:

A short settling time

Operation from a 24V DC electrical supply

This Manual is an important part of the Meridian Gyrocompass. It describes the System and contains full installation and operating instructions. You should retain the Manual with the System for use by personnel who will install and operate it.
Installation and operation of the Meridian Gyrocompass are not complex tasks. However, you should spend time to familiarise yourself with the contents of this Manual before you start to install or use the System. Time spent in identifying the task sequence now will ensure your System is operational in the minimum of time.

The Meridian Gyrocompass comprises two sub-assemblies:

The gyrocompass housing

The Remote Control Unit (RCU)

Figure 1–1 shows the combined gyrocompass housing with the RCU included as an integral unit.

The Meridian Gyrocompass applies dynamic tuning to settle automatically to the

meridian.
Due to the physical principles of a north-seeking gyrocompass, achievable accuracy depends on the operating latitude and the vessel dynamics. To optimise its performance, the Meridian Gyrocompass uses information supplied by external equipment, for example a GPS receiver and a speed log, to apply latitude and speed corrections.
Refer to Appendix A for a simplified explanation of the gyrocompass theory of operation .

2.2 Technical data

2.2.1 Power Requirements

Voltage	24V DC (acceptable range 18V to 36V DC)
Power consumption	3A at power on, 1.2A continuous (The power supply capacity should exceed 200W)

CAUTION

The Meridian Gyrocompass contains a non-isolated PSU. Therefore, you should supply it with power from an SELV source as defined in IEC/EN 60950. The power supply source should be switched and protected by a suitable circuit breaker.

To comply with the requirements of IMO Resolution A.821(19), Performance Standards for Gyrocompasses for High Speed Craft, power to the gyrocompass should be delivered by an uninterruptable power supply, for example the SGBrown UPS part number 929128.

2.2.2 Performance (definitions as in ISO 8728)

Settle point error	0.35° sec latitude
Static error	0.1° sec latitude RMS
Dynamic accuracy	0.3° sec latitude (Scorsby and Intercardinal motion tests)
Settle point repeatability	0.25° sec latitude
Follow up speed	200°/s
Time to settle within 0.7°	Less than 45 minutes with a ±30° initial heading offset

2.2.3 Compensation

Latitude compensation range	80°N to 80°S
Speed compensation range	0 to 90 knots

2.2.4 Environment

Operating environment	EN 6095:1997 designated category ‘weather protected’
Operating temperature	0°C to +45°C (to ISO 8728) –15°C to +55°C (with reduced accuracy)
Storage temperature	–25°C to +80°C

2.2.5 Signal Inputs

Latitude	IEC 61162 message string via RS232 or RS422from GPS
Speed	Pulse or contact closure at 100, 200 or 400 per nautical mile from speed log. IEC 61162 message string at 4800 baud via RS232 or RS422 from GPS or speed log

2.2.6 Signal outputs

S-type heading	1 × step-by-step, 6 steps per degree (TTL level) update limited to 20o/s to prevent repeater misalignment
Synchro heading	1 × 26V 400Hz (11.8V maximum line-to-line), sector value 360°
Resolver heading	1 × 36V 400Hz (8V maximum per phase),sector value 360°
Analogue rate of turn	1 × rate of turn ±60°/min (±10V) or ±20°/s (±10V)
Serial data outputs	6 × RS232 11 × RS422
Serial data formats	IEC 61162 at 1Hz or 10Hz. Course recorder output (heading, date, time)
Status/alarm	5V TTL power/gyro failure Voltage free power/gyro failure contacts 5V TTL system ready Voltage free system ready contacts

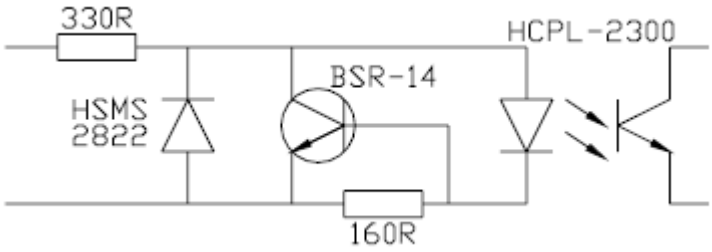
2.2.7 Dimensions and Weight

Dimensions	344mm (H) × 267mm (W) × 440mm (D)
Weight	15.5kg
RCU size (when mounted externally)	
	96mm (H) × 192mm (W) × 108mm (D)0
RCU weight	0.75 kg

2.2.8 Listener load requirement

The gyrocompass presents a listener load of 1.6mA typical at 2V or 3.5mA typical at 5V to all serial data input signals.

Figure 2–1: Listener input circuit



2.2.9 Talker drive capability

The gyrocompass has a talker drive capability of 150mA to ground.
Derived from 26C31 line drivers.

2.2.10 Standards

The Meridian Gyrocompass is designed to meet the requirements of the following:

- IMO Resolution A.424 (XI), Performance Standards for Gyrocompasses
- IMO Resolution A.821 (19), Performance Standards for Gyrocompasses for High Speed

Craft

- BS EN 60945 (January 1997), General Requirements - Methods of testing and required test results
- BS EN ISO 8728:1999, Shipbuilding – Marine Gyrocompasses
- BS 6217:1981, Graphical Symbols for use on Electrical Equipment
- CE marking
- Electromagnetic Compatibility (EMC) Directive
- The Marine Equipment Directive 96/98/EC
- IEC 61162-1:2000(E) Maritime navigation and radio communication equipment and systems- Digital interfaces. Note that IEC 61162-1:2000(E) is closely aligned with NMEA 0183 version 2.30.

2.3 Operation

This section explains how to power-on and configure the Meridian Gyrocompass after installation.

Refer to Section 4 for an explanation of the data formats relevant to the System.

2.3.1 CONTROL FEATURES

Figure 3–1: RCU front panel features

The RCU front panel includes all the operator controls for the Meridian Gyrocompass:

Table 3–1: RCU Control and Indicator functions

Control	Function
	Power switch. Recessed to prevent accidental operation.
	Selection Up. Press to increase display brightness.
	Selection Down. Press to decrease display brightness
	Latitude selection button. Press to display current Latitude source and correction value. Use in conjunction with the Selection Up and Selection Down buttons to pre-set Latitude source and correction value.
	Speed Selection. Press to display current Speed source and correction value. Use in conjunction with the Selection Up and Down buttons to pre-set Speed source and correction value.
	Alarm. Press to silence the audible alarm.
012.3	Four digit alphanumeric display. **Note:** The display can show additional information by alternating the display contents at 0.5Hz. This is indicated throughtout the manual as, for example, LSAT+ SGPS
Power lamp (red)	Indicates that the Meridian Gyrocompass is switched on when 24V DC nominal power is connected.
Ready lamp (green)	Indicates that the Meridian Gyrocompass has settled and a True Heading is available.

Table RCU display formats

Format	Function

Heading 0123.4 0123.4 + DG 0123.4 + DG_L 0123.4 + DG_X	Heading Only Heading with DG mode set at the RCU Heading with DG mode set by latitude greater than 80 deg Heading with DG mode set by Distribution PCB connection
Speed (by pressing the Speed button) S_01 + S.MAN S_01 + S.GPS S_01 + S.LOG S_01 + P.LOG	Speed value with Manual selected speed source Speed value with GPS selected speed source Speed value with LOG selected speed source (serial data input) Speed value with LOG selected speed source and Pulse Log DIP switch set (pulse input)
Latitude (by pressing the Latitude button) L.52N + S.MAN L.52S + S.MAN L.52N + S.GPS	Latitude value in the Northern Hemisphere with Manual selected Latitude source Latitude value in the Southern Hemisphere with Manual selected Latitude source Latitude value with GPS selected Latitude source

2.3.2 INITIAL POWER-ON

The Meridian Gyrocompass starting cycle is fully automatic after power is applied. For correct operation Latitude and Speed correction must be applied.

1. Check that there is a nominal 24V DC electrical supply available to the gyrocompass. The acceptable supply range is 18V to 36V DC.

To ensure continuous operation, the power supply for this unit should have a 200W power rating.

2. To start the Meridian Gyrocompass press the power switch on the RCU.

3. Check that the red 'Power' lamp on the RCU illuminates. This lamp indicates only that the Meridian Gyrocompass is receiving power and does NOT indicate a settled condition.

Check that the instrument illumination is at maximum during the initialisation sequence. Even at its maximum setting, the instrument illumination may be difficult to see in bright ambient lighting.

4. The RCU will activate the audible alarm for about 1 second. The display will indicate T.E.S.T. and the 'Ready' lamp will be lit for about 10 seconds while the system performs a series of self-tests. After successful completion of the self-tests, the display will show the current Gyrocompass dial heading and the 'Ready' lamp will go off until the Gyrocompass has settled.

5. Set the source of latitude information by following the instructions in sub-section

3.3.1.
6. Set the source of speed information by following the instructions in sub-section 3.3.2.
7. Use the increase and decrease selection buttons to adjust the RCU illumination level to a comfortable setting.
8. Wait for the gyrocompass to settle. This will occur automatically and will take upwards of 24 minutes depending on initial heading offset and sea conditions. The Meridian Gyrocompass signifies its settled condition by illuminating the green 'Ready' lamp.
9. If necessary, you can view the software versions of the main and the control panel processors by pressing both the Up and the Down selection buttons simultaneously. The display will toggle between indications of the main processor software version (with prefix 'M') and the control panel software (with prefix 'R'). The display will continue to toggle for several seconds after you release the buttons and will then return to the heading indication.

2.3.3 OPERATING PROCEDURE

The Meridian Gyrocompass will settle automatically after power-on, to provide a true north reference. The system requires only latitude and speed correction, applied manually or from external sources, to perform to the specified accuracy.
Ideally, the Meridian Gyrocompass should accept latitude and speed information from external sources such as a GPS receiver or a speed log, which allow the System to apply corrections automatically.

2.3.3.1 Latitude correction

1. Press and hold the Latitude selection button.
2. Use the up and down selection buttons to set the local latitude manually.
The display will show the latitude in one-degree increments in the range 80°N to 80°S, for example L70N

To select automatic latitude compensation from a GPS receiver, use the up or down selection buttons to scroll beyond 80°N or 80°S until the display shows LGPS
If there is no valid input available from a GPS receiver, the display will indicate a LGPS alarm after 30 seconds.
3. Release both buttons to set the latitude to the displayed value or to set the gyrocompass to use GPS as the source of automatic latitude correction. The display will indicate the latitude setting and latitude source for several seconds and will then return to the normal heading display.
If you input the operating latitude manually, remember to change the setting when necessary.
Note that, in medium latitudes, a 10° error in setting the operating latitude will result

in a compass error of approximately 0.3°.

2.3.3.2 Speed correction

1. Press and hold the Speed selection button.
2. Use the up and down selection buttons to set the speed manually in the range zero to 90 knots.

To select automatic speed compensation from a GPS receiver or a speed log, use the up selection button to scroll beyond 90 knots until the display shows SGPS or SLOG.

If there is no valid input available from a speed log or GPS receiver, the display will indicate a SLOG or SGPS alarm after 30 seconds.

3. Release both buttons to set the speed to the displayed value or to set the gyrocompass to use GPS or a speed log as the source of automatic speed correction. The display will indicate the speed setting and speed source for several seconds and will then return to the normal heading display.

If you input the vessel speed manually, remember to set the average vessel speed and to change the setting when necessary. Return the setting to zero on completion of the voyage. For a vessel steaming in a northerly direction, a 5-knot error in speed setting will generate an error of approximately 0.5°.

2.3.3.3 DG operating mode

Follow the instructions in sub-section 3.3.1 to set the latitude correction to the Directional Gyro (DG) mode. In this mode you can use the Meridian Gyrocompass as a direction indicating instrument all the way up to the poles. If the gyrocompass has settled on north immediately prior to entering the DG mode, it will continue to provide a useful indication of the northerly direction for a period, but will not continue to seek north. The length of time that the direction indication remains valid depends entirely on the gyro drift characteristics.

Note: DG mode will be automatically enabled for latitudes set greater than 80 deg.

Note: that the gyrocompass will not north seek while operating in the DG mode.

2.3.4 ERROR MODES

The Meridian Gyrocompass has three possible Error modes:

1. Loss or corruption of GPS signal
2. Loss or corruption of speed log signal
3. Gyrocompass system warnings and failures

2.3.4.1 Loss of GPS

This failure mode can occur when you have selected GPS as the source of speed or latitude information and the signal corrupts or becomes lost for a period of 30 seconds. You can recognize this condition by the following indications:

The display shows S.GPS + FAIL for the loss of speed correction information.

The display shows L.GPS + FAIL for the loss of latitude correction information.

The audible alarm will sound.

Press the Alarm button to cancel the audible alarm.

1. The Gyrocompass will use the last valid speed and latitude values.
2. The RCU will continue to show the alarm message until a valid input signal is re-established or a different input source is selected.
3. If the valid input signal has not been established within a period of 30 minutes the audible alarm will be enabled.

2.3.4.2 Loss of speed log

This failure mode can occur when you have selected speed log as the source of speed information and the signal corrupts or becomes lost for a period of 30 seconds. You can recognise this condition by the following indications:

The display flashes SLOG + FAIL for the loss of selected serial data source information.

The display flashes pLOG + FAIL for the loss of pulsed selected source information.

The audible alarm will sound.

Press the Alarm button to cancel the alarm.

1. The Gyrocompass will use the last valid speed value.
2. The RCU will continue to show the alarm message until a valid input signal is restablished or a different input source is selected.

If a valid input signal has not been established within a period of 30 minutes the audible alarm will be enabled.

2.3.4.3 Gyrocompass system warnings and failures

The Meridian Gyrocompass has a built-in system that monitors operation of the gyrocompass.

The functions that this system checks are split into two categories.

Warning conditions

Failure conditions

A failure condition warning will result in the Gyroscope power supply being disabled. Refer to the maintenance section before activating the Power Supply.

Warning Conditions

If the gyrocompass detects a warning condition, it will use two methods to alert you:

The display shows <Message> + FAIL

The audible alarm will sound.

Press the Alarm button to cancel the audible alarm

Table 3–3: Gyrocompass warning codes

<Message> RCU Screen	Definition of warning code
Temp + fail	Over or under operating temperature range
RMT + fail	Loss of serial communication link with the RMT

The RCU will continue to show the alarm message until the fault condition has been removed.

If the fault condition has not been removed within a period of 30 minutes the audible alarm will be enabled. Refer to sub-section 5.1 which outlines some simple checks that you can make to rectify these fault conditions. If necessary contact SG Brown or an approved local service agent for assistance.

Failure Conditions

If the Meridian Gyrocompass detects a failure condition, it will use six methods to alert you:

The display shows <Message> + FAIL

The audible alarm will sound.

The 'Ready' lamp will extinguish.

The Gyro Fail relay will activate.

Serial output will transmit empty sentences.

Stepper output will transmit an illegal code.

Press the Alarm button to cancel the audible alarm.

Table 3–4: Gyrocompass failure codes

<Message> RCU Screen	Definition of failure code
dc + fail	Internal DC power supply is outside operating limits
ac + fail	Internal AC power supply is outside operating limits
rdc + fail	Loss of internal timing signals
APO + Fail	High Azimuth pick-off signal
tpo + Fail	High Tilt Pick-off signal
rot + Fail	Rate of Turn exceeds 300o/s

These failures are considered to render, or be due to an unrecoverable fault condition,

possibly due to a component failure.
To prevent damage to the Gyroscope the power supplies to it will be disabled.
The Gyrocompass will be disabled until it has been reset by the operator. Refer to the maintenance section before activating the Power Switch.

2.3.5 OPERATING CONSIDERATIONS

2.3.5.1 General Operating Considerations

You should leave the Meridian Gyrocompass running continuously. Power-off the system only during long periods of lay-up, for example during vessel dry-docking. To power-off the Meridian Gyrocompass, press the 'Power' button. The heading display will go blank and the front panel lamps will switch off. The gyro rotor will take approximately ten minutes to come to rest.

If you intend to leave the system powered-off for an extended period, you should arrange to run the gyrocompass for a period of at least thirty minutes at intervals of six months or less.

The Meridian Gyrocompass has full protection against interruption of its electrical supply. It will re-start and align itself automatically on restoration of electrical power. The heading indication will be accurate when the RCU 'Ready' lamp is on.

Monitor the Meridian Gyrocompass performance regularly. When functioning correctly, and provided the correct Speed and Latitude compensations are applied, the heading error in latitudes up to 60° and for speeds up to 25 knots will normally be less than 0.75° regardless of the vessel manoeuvres.

Never move the gyrocompass with the gyro rotor spinning unless you leave the servos operational. Note that the gyro rotor continues to spin for a period of approximately five minutes after you power-off the gyrocompass.

2.3.5.2 Corrections for Speed and Latitude

Gyrocompass operational accuracy depends, to a large extent, upon accurate corrections for speed and latitude being applied.

Most users find that the facilities for the automatic application of speed and latitude corrections, via signal inputs from GPS and/or ships log, are a convenient method of applying corrections.

However, users should be aware that if the input signal contains the wrong information, then the wrong corrections will be applied. For instance, it has been noted that some GPS installations, under certain circumstances, will output a "valid" signal with the speed and latitude fields set to all zeros indicating that the vessel is stationary on the equator.

An incorrect input of speed and/or latitude will cause the gyrocompass to indicate an incorrect heading and in the case of extreme errors could cause, in certain

circumstances, the gyrocompass to come out of the “Ready mode”.

2.3.5.3 Operating at Extremes of Latitudes

As latitude increases (north or south) the magnitude of the horizontal component of the Earth’s rotation rate reduces in proportion to the cosine of latitude. Consequently, the effectiveness of the gyrocompasses north seeking action reduces with increasing latitude.

At latitudes greater than 80o it is recommended that the gyrocompass be operated in the directional gyro mode.

If correction for the effect of latitude on the vertical component of Earth’s rotation is made manually via the RCU, then correction is available to 80o. Thereafter, the directional gyro mode should be manually selected. Errors in the indicated heading will increase with time and increasing latitude above 80o to a maximum of approximately 0.25° /hour. To re-align the gyrocompass, operating latitude must be reduced below 80o and the gyrocompass mode of operation re-selected.

If correction for the effect of latitude on the vertical component of Earth’s rotation is made automatically via a serial data input, then correction is available above 80o and directional gyro mode is automatically selected above this latitude. The compass will still be subject to small inherent drifts while operating in this mode. Reversion to the gyrocompass mode will be made automatically when the serial data latitude input falls below 80°.

2.3.5.4 Operating Considerations for High Speed Craft

The gyrocompass gravity control gives rise to errors whenever the gyrocompass accelerates or decelerates along the north-south line, that is whenever the northerly speed or course changes. These errors are caused by the inertia of the pendulous element of the gyro, which produces a torque about the horizontal axis and therefore a precession in azimuth.

This effect, called ballistic deflection, causes an increase in error during acceleration.

The precession in tilt that arises from the damping component of gravity control is called ballistic tilt. The combined effects of ballistic tilt and ballistic deflection cause the gyrocompass to tilt downwards. Because of the factors that guide the behaviour of a damped gyroscope, the gyro spin axis will return to the settled position by the normal anticlockwise spiral after the acceleration has ceased.

In the Meridian Gyrocompass, gravity control comes from an accelerometer (pendulum), which generates an electrical signal related to the tilt of the gyro spin axis. This devices has two important design features; it is heavily damped and the range of output is restricted to a small angle.

The use of accelerometer damping by the Meridian Gyrocompass is of prime importance in the reduction of a particularly serious form of ballistic error called inter cardinal rolling error. This type of error occurs most noticeably when the vessel

steams on an inter cardinal heading while rolling simultaneously through a significant angle.
If the gyrocompass is installed at some distance above the vessel centre of roll rotation, as is usually the case on commercial vessels, the resulting lateral acceleration components along the east-west and north-south axes of the gyrocompass combine to build an error in the northerly settle point.
If the effect persists for long enough, this error might become as large as several degrees. However, by damping the accelerometer using a time constant several times larger than the vessel rolling period, inter cardinal rolling errors are significantly reduced.

Another form of ballistic error arises from north-south accelerations generated by vessel manoeuvres. Such accelerations can arise from changes in speed and/or course. By limiting the angular output of the accelerometer, the Meridian Gyrocompass reduces the error potential typically to less than one degree.

It is also possible to eliminate acceleration effects by temporarily operating the compass in the DG (Directional Gyro) mode. In this mode gravity control is used for tilt corrections only, so that ballistic effects would cause negligible heading error during short-term acceleration periods. The DG mode can be selected manually from the control panel.

The Meridian Gyrocompass complies with all requirements of IMO Resolution A.821(19), Performance Standards for Gyrocompasses for High-Speed Craft.

3 Maintenance
There is very little need for user maintenance on the Meridian Gyrocompass and you should never need to remove the covers.
The following sub-sections explain some very basic procedures that you may attempt if you suspect the system has developed a fault. If you are in any doubt, contact SG Brown for advice and technical assistance before you begin any maintenance work on the system.

2.4 Maintenance

2.4.1 BUILT-IN TEST EQUIPMENT

In Subsection 3.4.3 there are a list of two warning codes and five failure codes delivered by the built-in test equipment if it detects a fault in the gyrocompass. In these conditions, the four character display will show <Message> + FAIL
If the built in test equipment detects a fault, use the following table to investigate the cause. You can measure the voltages and signals on the pins of the 60-way test connector (refer to Table 4–2 for details of the test connector).
Table4–1: Test measurements

Failure Code	Measure	Expected value	Signal source

dc+fail Failure of DC power supply	DC supply 42 (+ve) to 43 44 (+ve) to 43 17 (+ve) to 18 50 (+ve) to 51 52 (+ve) to 51 45 (+ve) to 18	18V DC to 36V DC +24V DC ±0.5V DC –24V DC ±0.5V DC +5V DC ±0.1V DC +15V DC ±0.2V DC –15V DC ±0.2V DC +5V DC (+0.2V/–0.7V DC)	Ship's mains/PSU DC/DC PSU DC/DC PSU DC/DC PSU Control Board analogue Control Board analogue Control Board analogue
ac+fail Failure of AC power supply	19 to 43 20 to 43 21 to 43 58 to 43 57 (+ve) to 18	2.5V AC ±0.125V AC @ 19.2kHz 10V AC ±1V @ 480Hz (18V AC ±1.5V at start (1-min)) 10V AC ±1V @ 480Hz (18V AC ±1.5V at start (1-min)) 12V AC ±0.2V @ 400Hz +5V DC ±0.2V DC	Control Board analogue Control Board analogue Control Board analogue Control Board analogue Control Board analogue
tpo +fail High tilt pick-off signal	10 (+ve) to 18 16 (+ve) to 18 37 (+ve) to 51	+5V DC ±0.2V DC (0V DC ±0.2V DC at start (1-min)) +5V DC ±0.2V DC (0V DC ±0.2V DC at start (2-min)) 0V DC ±1V DC	Control Board digital Control Board digital Control Board analogue
apo+fail High azimuth pick-off signal	10 (+ve) to 18 16 (+ve) to 18 38 (+ve) to 51	+5V DC ±0.2V DC (0V DC ±0.2V DC at start (1-min)) +5V DC ±0.2V DC (0V DC ±0.2V DC at start (2-min)) 0V DC ±1V DC	Control Board digital Control Board digital Control Board analogue
rdc+Fail Failure of synchro-todigital converter	58 to 43 53 (+ve) to 51 54 (+ve) to 51	12V AC ±0.2V @ 400Hz (5.4V DC ±0.5V DC) × sin heading (5.4V DC ±0.5V DC) × cos heading	Control Board analogue Control Board analogue Control Board analogue
rMT+fail Loss of RMT communication		50 way IDC Cable (Part Number B929157) + 5V DC Power Supply 50 way Cable Loom (Part Number B929161)	
ROT+fail Rate of turn	>300o/s	Check Gyro connection to the analogue PCB	

exceed limit			
Temp+fail Temperature exceeds operating range	<-20oC >+60oC	Check operating environment and ventilation	

2.4.1.1 Azimuth Drift Adjustment

You may use the following procedure to measure and, if necessary, adjust the azimuth drift:
1. Ensure that the gyrocompass is static and is operating in DG mode with the Speed input set manually to zero and the Latitude set to local latitude. Use the DIP switches to set DG mode – refer to Table 2–5. Refer to sub-sections 3.3.1 and 3.3.2 to set the latitude and speed.
2. Note the initial heading (H1) shown on the RCU display.
3. Wait for one hour and then note the heading (H2) shown on the RCU display.
4. Calculate the azimuth drift rate (H2 – H1) degrees per hour.
5. Use a digital meter set to measure DC volts and monitor the Tilt Bias between pins 30 and 51 of the 60-way test connector (with the positive test lead on pin 30).
6. Adjust the Tilt Bias potentiometer RV7 by 400mV × drift rate (°/hr). You must turn the potentiometer anticlockwise to compensate for azimuth drift towards higher readings. Figure 2–4 shows the location of the Tilt Bias potentiometer.
7. Repeat steps 1 and 2 above to ensure that the calculated drift rate is less than 0.2°/hr.

2.4.1.2 Azimuth Bias Adjustment

You may use the following procedure to eliminate small angles of heading error from the Meridian Gyrocompass . Measure and, if necessary, adjust for azimuth drift as described in sub-section 4.1.1 above before you adjust the azimuth bias.
Take care when you adjust azimuth bias – make only small adjustments each time and then allow the gyrocompass to settle for three hours before you make any further adjustments. Note the original position of the azimuth bias control before you start so that you can restore the starting condition if necessary.
1. Use a digital meter set to measure DC volts and monitor the Azimuth Bias between pins 29 and 51 of the 60-way test connector (with the positive test lead on pin 29).
2. Adjust the Azimuth Bias potentiometer RV9 to cause a change in the azimuth bias voltage that will produce the necessary change in compass heading. Figure 2–4 shows the location of the Azimuth Bias potentiometer.
3. Turn the Azimuth Bias potentiometer anticlockwise to cause the heading to change towards a lower reading. A 60mV DC change in Azimuth Bias will produce a 1-degree change in heading

2.4.2 TEST CONNECTOR

There is a sixty-way test connector accessible behind the removable panel on the top of the gyrocompass cover. Release and remove the securing screws and lift off the panel to see the two DIP switches and the test connector. A test box (SG Brown part number 929220) is available to facilitate connection to the 60-way test connector.
Table 4–2: Sixty-way test connector

Pin	Name	Function
1	S1_SYNCHRO	11.8V RMS 400Hz synchro S1 phase
2	S2_SYNCHRO_RES	11.8V RMS 400Hz synchro S2 phase
3	S3_SYNCHRO_RES	11.8V RMS 400Hz synchro S3 phase
4	26V_SYNCHRO_R1	26V RMS 400Hz synchro R1 reference
5	0V_SYNCHRO_RES	26V RMS 400Hz synchro R1 reference
6	GA_MODE	Directional gyro mode control (+5V logic)
7	GC_MODE	Gyrocompass mode control (+5V logic)
8	AA_MODE	Auto alignment mode control (+5V logic)
9	LAT_NS	Latitude north selection control (+5V logic)
10	SERVO_EN	Tilt and azimuth servo enable control (+5V logic)
11	WHEEL_BOOST	Gyro wheel supply boost control (+5V logic)
12	LOG_OK	Speed log OK flag (+5V logic)
13	GPS_OK	GPS OK flag (+5V logic)
14	SYS_FAIL	System fail flag (+5V logic)
15	GYRO_RDY	Gyrocompass ready flag (+5V logic)
16	PREPARE	Prepare mode (servo nulling) (+5V logic)
17	VCC	5V DC supply
18	GND	5V DC supply return
19	PICK_OFF_SUPPLY_1	Gyro pick off supply 2.5V RMS 19.2kHz sine wave
20	WHEEL_SUPPLY_1	Gyro wheel supply 0 phase 10V (18V) RMS 480Hz square wave
21	WHEEL_SUPPLY_2	Gyro wheel supply 90 phase 10V (18V) RMS 480Hz square wave
22	PWMO	Compass card illumination PWM control 5V 85Hz square wave
23	ACC	Gravity control signal ±150mV DC/min T=60s
24	10V	10V DC positive voltage reference
25	_10V	10V DC negative voltage reference
26	LAT_TORQ	Latitude torquing input signal (–10 sin[latitude])V DC
27	SPEED_N_TORQ	Speed N torque i/p signal (7.3e–3 × speed(kts) × cos[heading])
28	SPEED_E_TORQ	Speed E torque i/p signal (–8.5e–3 × speed(kts) ×

		sin[heading] × tan[latitude]V DC
29	AZ_BIAS	Bias adj. to azimuth torquer ±2.2V DC (60mV/deg heading)
30	TILT_BIAS	Bias adj. to tilt torquer ±2.2V DC (400mV/deg/hour heading)
31	TILT_TEMP	Bias adj. to tilt torquer proportional to temperature (400mV/deg/hr heading)
32	AZ_TEMP	Bias adj. to azimuth torquer proportional to temperature (60mV/deg/hr heading)
33	T	Temperature ref (non-inverted) from gimbal thermistor (DC V proportional to temp)
34	T_	Temperature ref (inverted) from gimbal thermistor (DC V proportional to temp)
35	TILT_TORQUER_LO	Tilt torquer signal 0.013V DC/mA (torquer scale factor 10°/hr/mA)
36	AZ_TORQUER_LO	Azimuth torquer signal 0.006V DC/mA (torquer scale factor 10°/hr/mA)
37	TILT_PICK_OFF_DC	Demodulated gyroscope tilt pick-off signal
38	AZ_PICK_OFF_DC	Demodulated gyroscope azimuth pick-off signal
39	18V10V	Gyro wheel positive supply
40	-18V10V	Gyro wheel negative supply
41	UP_DOWN	Accelerometer - Slave comparator
42	24V	24V DC positive supply
43	0V	Supply return for ±24V DC
44	–24V	24V DC negative supply
45	PSU_LO	PSU (+5V DC and ±15V DC) under voltage flag (+5V DC logic)
46	NOT USED	
47	ACC_COS_LAT	Latitude weighted gravity control signal (150/cos latitude)mV DC/min
48	SLAVE	Slave accelerometer gravity control signal (10mV/bit)
49	ROT	Analogue rate of turn output (0.5V DC/deg/s (10V DC max)
		CW +ve; ACW –ve
50	15V	15V DC positive supply
51	0Va	Supply return for ±15V DC
52	–15V	15V DC negative supply
53	SIN_DC Analogue	voltage proportional to sin(heading) (±0.1V DC/deg heading)
54	COS_DC	Analogue voltage proportional to cos(heading) (±0.1V DC/deg heading)
55	RS232_RX_TEST	RS232 receive port reserved for product testing
56	RS232_TX_TEST	RS232 transmit port diagnostic output sentence

57	AC_OK	AC supply (19kHz, 480Hz and 400Hz) OK flag (+5V DC logic)
58	400_REF_HI	Reference supply 12V RMS 400Hz
59	AZ_MOTOR_HI	Drive to azimuth follow-up DC servo motor
60	TILT_MOTOR_HI	Drive to tilt follow-up DC servo motor

2.4.3 DIAGNOSTIC OUTPUT SENTENCE

An ASCII character diagnostic sentence, delivered via RS232 line standard at 4800 baud, is available at test connector PL6/56-18(GND).
Note that this sentence information is only valid for gyrocompasses fitted with software of the following version or newer: BPR 113 (main) and BPR 114 (RCU).
This sentence may usefully be monitored when communicating with SG Brown for technical assistance.The sentence string may be read using "Microsoft Terminal" or similar ASCII reader.

Sentence Structure

Gyro Control

1 = slave accelerometer (new hardware)

S = special applications only (new hardware)

R = real accelerometer (original hardware)

A = special applications only (original hardware)

Mode

L = level

A = alignment

C = compass

D = DG

Status

F = fail

R = ready

S = settle

Latitude (degrees) xx

Hemisphere N or S

Speed (knots) xx

Average Accelerometer (bits) Paxxx

ADC 1 (bits) rxxx

ADC 2 (bits) hxxx

ADC 3 (bits) txxx

ADC 4 (bits) axxx

ADC 5 (bits) Txxx

DAC 1a (bits) xxx

DAC 1b (bits) xxx

DAC 2a (bits) xxx

DAC 2b (bits) xxx

DAC 3a (bits) xxx

DAC 3b (bits) xxx

Heading (degrees) $HEHDT,xxx.xx,T

Sentence Example

R CR 51N 06 Pa128r128h128 t128a128 T096 160 198 000 000 128 128 $HEHDT,000.00,T

During start-up, the Mode and Status characters will change in the following sequence:

1. LS for about 4 minutes
2. AS for 25 - 60 minutes (dependent upon initial heading misalignment)
3. CR in READY mode and functioning

Ensure that the Latitude and Speed values in the sentence correspond with the automatic or manually set values applied to the gyrocompass. Ensure that the Heading value in the sentence is correct.

SG Brown may use the remaining (bits) characters when diagnosing fault conditions.

Figure 4–1: System Block Diagram

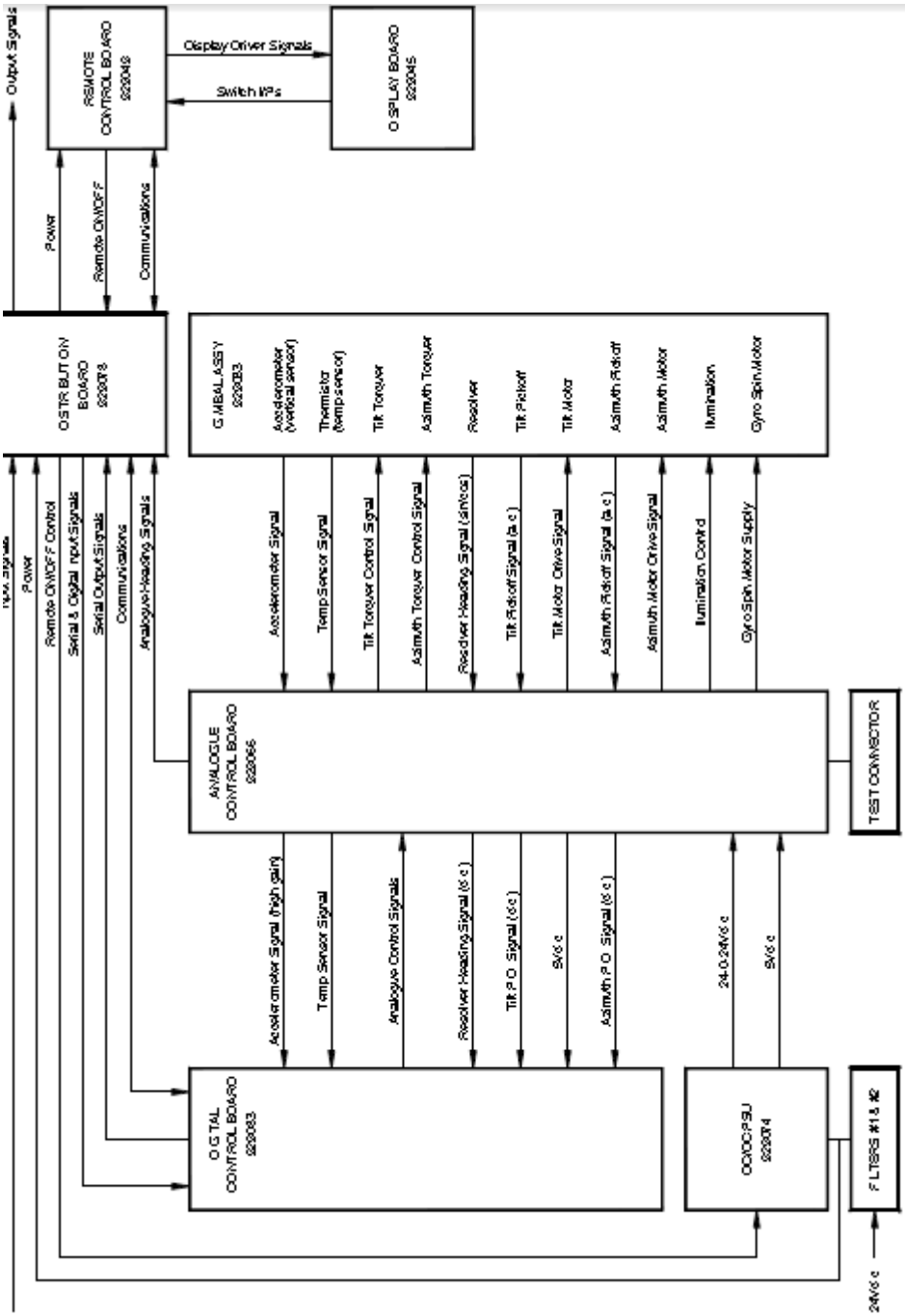


Figure 4–2: Gimbal Assembly Functional Diagram

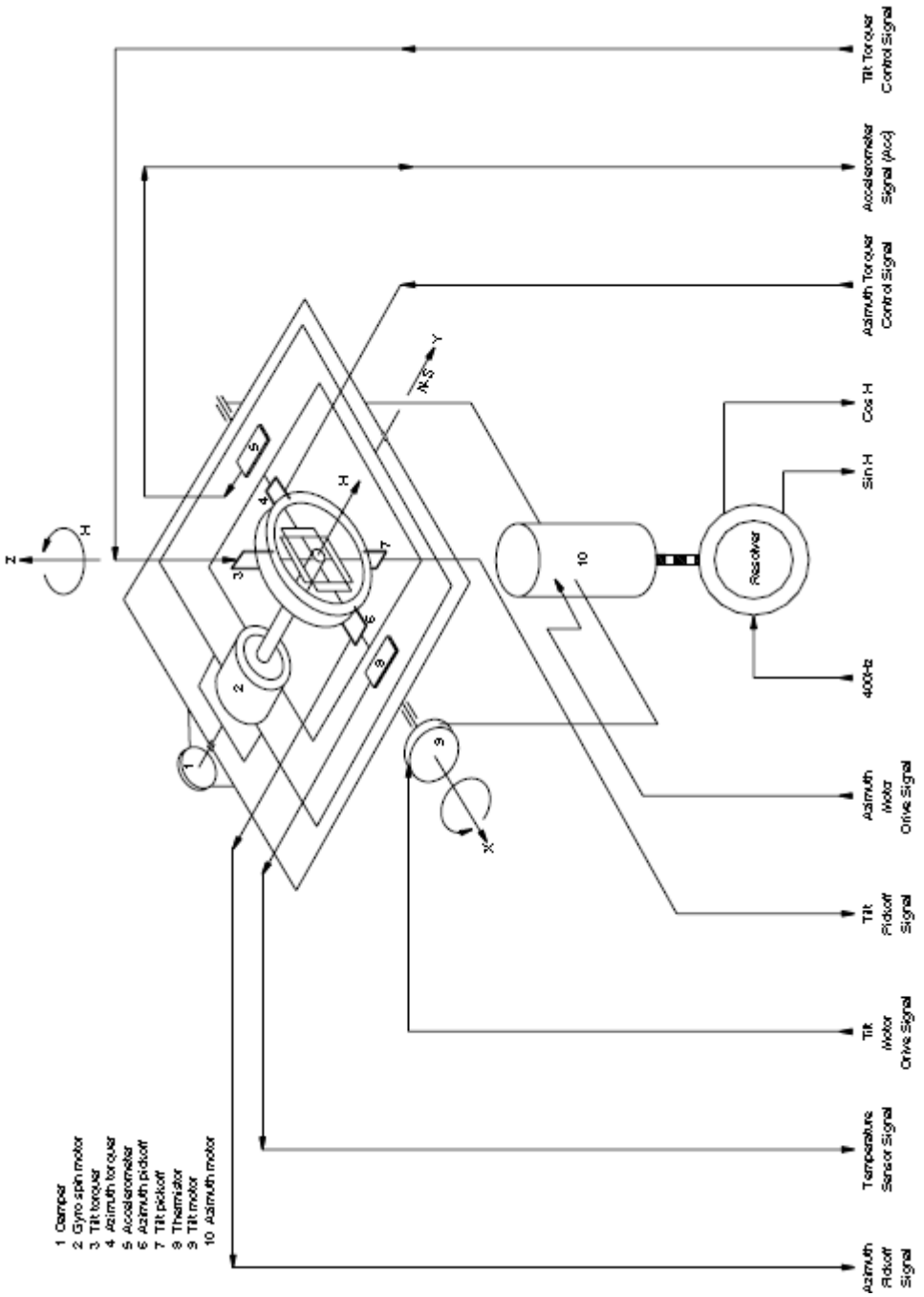


Figure 4–3: Analogue Control Board Block Diagram

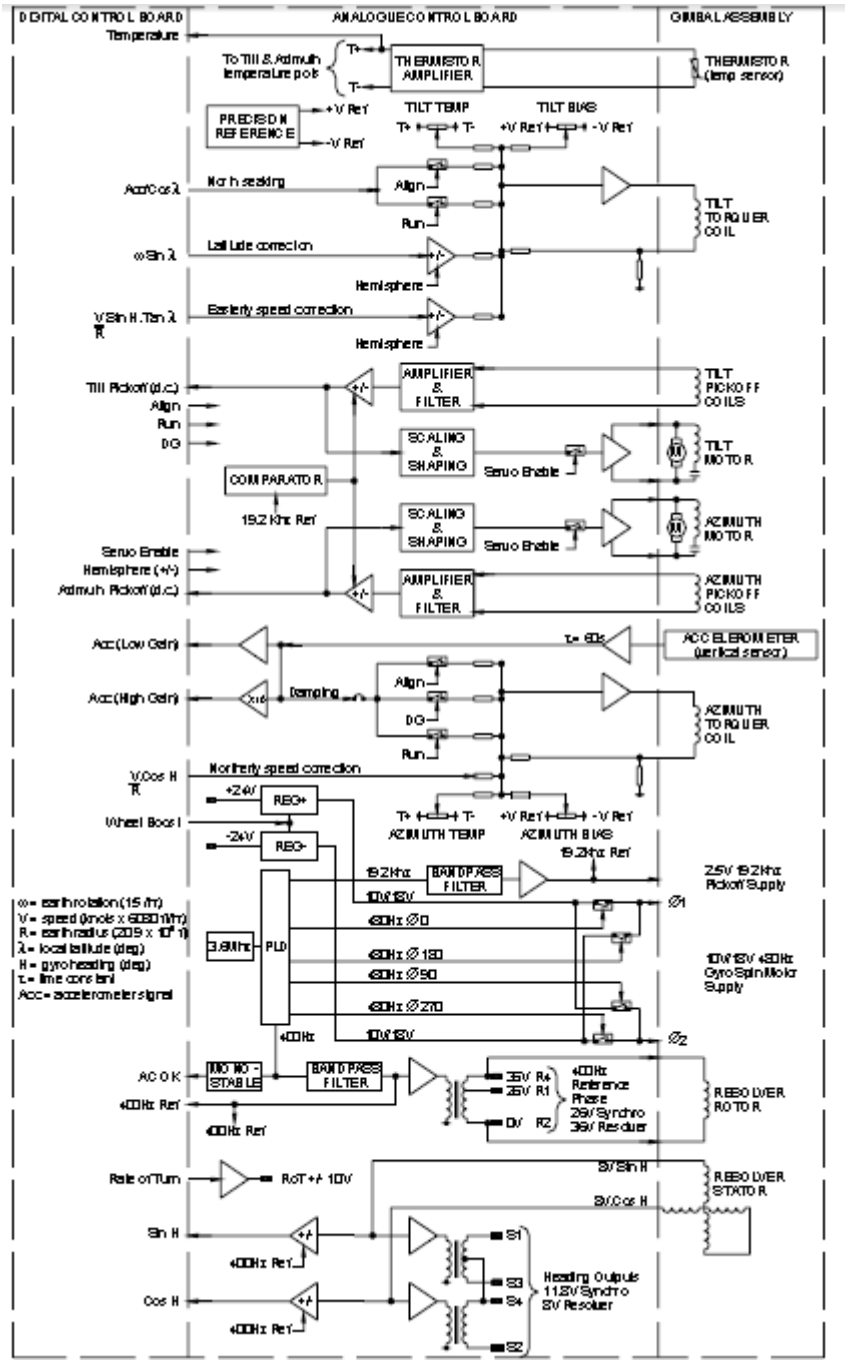


Figure 4–4: Digital Control Board/Remote Control Board Block Diagram

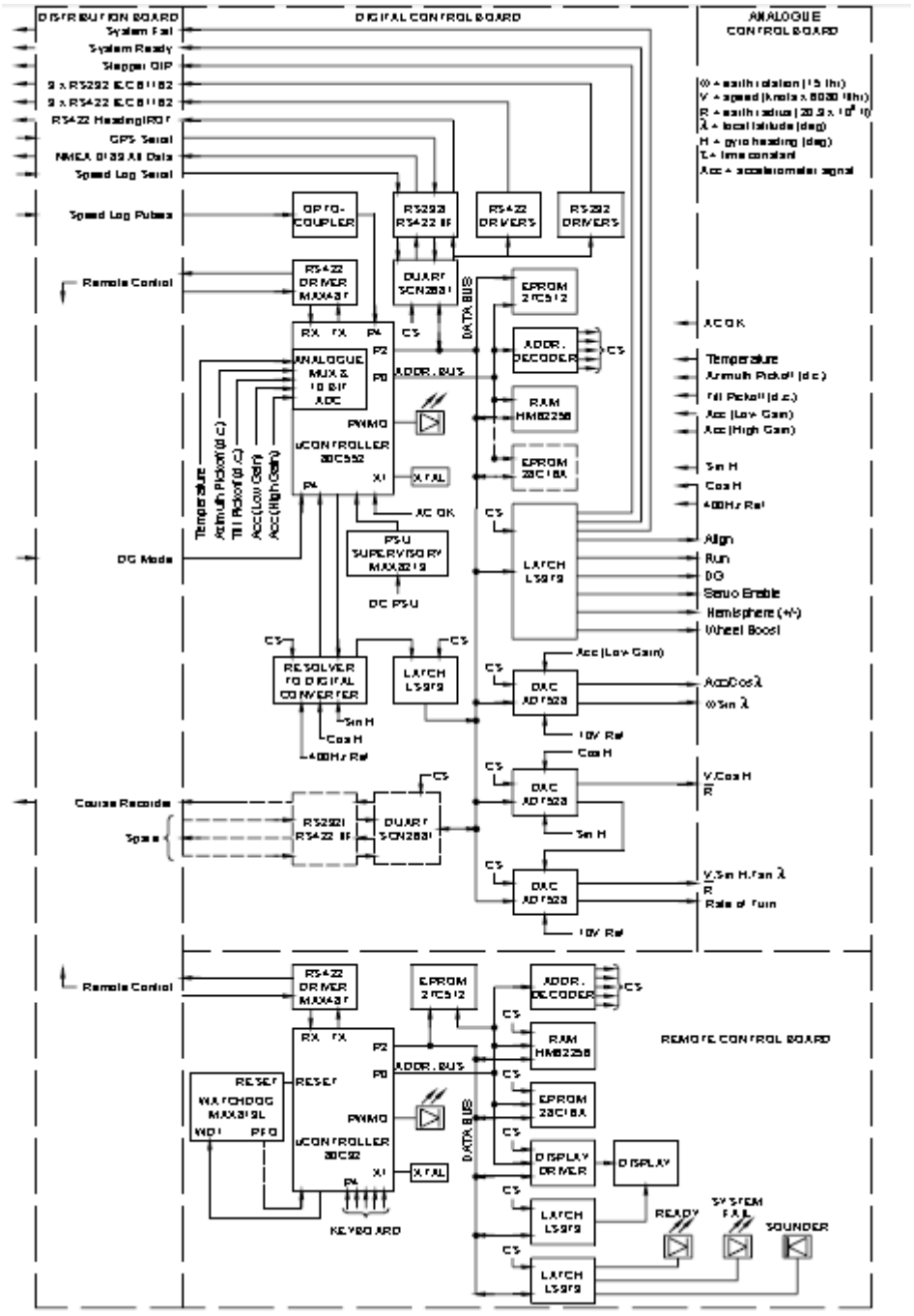


Table 4–3: Spares list for Meridian Gyrocompass 929060

SG Brown P/N	Description
929033	Gimbal assembly
929066	Control Board Analogue
929083	Control Board Digital
929049	Control Board Remote
929045	Display Board
929074	DC/DC Power Supply
856000	Filter #1
929160	Filter #2

346808	Fuse link 3.15A 250V
929164	Gland Plate assembly
929190	RCU Mounting Kit
929194	Transit case
929220	Test box

3 NAVIGAT X MK 1

3.1 System overview

NAVIGAT X Mk 1 / SR-180 Mk 1 is a microprocessor controlled gyrocompass system with integrated automatic north speed error correction.
The system is type approved by the German Federal Maritime and Hydrographic Agency (BSH) and complies with IMO resolutions A.424 (IX) and A.574 (14) as well as DNV-W1 and ISO standard 8728.
For use in high speed craft, an optimized system is available, which complies with IMO resolution A.821 (19) - HSC.
C. PLATH's unique method of supporting the gyrosphere by means of mere buoyancy ensures north stabilization during short power failures. For example, after a three minute loss of power, no more than two degrees of deviation may be expected. Once power has been restored, the gyrocompass will return quickly to the correct heading without requiring the usual settling period. The combined effects of the twin rotors an the liquid damping system virtually eliminate latitude error.
Heading is measured as a 12 bit absolute value by means of a digital shaft encoder. The high-speed follow-up system (> 100 ° /sec.) ensures extremely accurate measurements of heading and rate of turn under all operating conditions.
The system features an integrated TMC-function (magnetic compass transmission) and input interfaces for a second gyrocompass, speed log, position receiver and two rudder angle feedback units.

The gyrocompass provides 12 independent serial data outputs to analogue or digital repeaters (including short-circuit-proof 24 VDC repeater power supply), RS 422 and NMEA sensor data outputs, a special NMEA Fast output interface (reduced dataset) and a NMEA Superfast output interface (adjustable baudrate, max 38400 baud). Furthermore, two 6 step/° heading outputs, an analogue rate of turn output and an inter- face for the voyage data printer NAVIPRINT are provided.
Integrated monitoring and alarm functions for the supply powers, gyroscope temperature and current and the follow-up system ensure secure and trouble-free operation of the system.
The single unit design with a polyurethane hard foam housing of low weight allows the gyrocompass system to be installed on any bridge, from large yachts to the most capacious merchant vessels. If required, the integrated control and display unit may be installed at a remote location from the gyrocompass or an additional remote operating unit installed.
As an option, a special "compass monitor" control unit is available, which provides additional independent monitoring functions and features a numerical keypad, which facilitates the operation of the system.
An optional switch-over unit for twin gyrocompass systems provides for complete redundancy of all in- and output signals and thus ensures the independence of the

individual compasses.

3.2 Technical data

heading display 4-digit
follow-up speed ..... > 100° /s
mean settling time..... < 3 h
freedom of roll and pitch ..... ±40°

Accuracy standard system
linear mean settle point error ..... ≤ 0.1° sec lat
static error ..... ≤ 0.1° sec lat
dynamic error ..... ≤ 0.4° sec lat
max. deviation after power interruption of 3 min..... < 2°

HSC-system (high speed craft) ..... accuracies comply to IMO resolution A.821(19) - HSC

Ambient Temperature Range
operation ..... -10 – +55 ° C
storage ..... -25 – +70 ° C (w/o supporting fluid)

Power Supply
supply voltage ..... 115/230 V~ ±10%; including automatic switchover to 24 V emergency power supply in accordance with GMDSS rules for INMARSAT/SES terminals
or ..... 24 VDC (18 - 36 V)

Protection Grade ..... IP 23 in accordance with DIN 40050
Environmental Requirements and EMC ..... in accordance with IEC 945

Power Consumption	DC	AC
start-up	80 W	125 VA
operation	45 W	75 VA
each analogue repeater	7W	7 VA
each digital repeater	7 W	7 VA

Data Outputs

repeater outputs.....12 gyrocompass heading, magnetic compass heading, rate of turn, heading reference status; supply power 24 VDC, max. 7 W each

data outputs NMEA.....2 gyrocompass heading, magnetic compass heading, rate of turn, position, speed, heading reference status

data outputs RS 422 .....3 gyrocompass heading, magnetic compass heading, rate of turn, position, speed, heading reference status

data output RS 422 FAST.....1 gyrocompass heading, magnetic compass heading, rate of turn

data output RS 422 SUPERFAST .....1 gyrocompass heading, magnetic compass heading, rate of turn, heading reference status

6 step/° -outputs.....2 act. heading; 24 VDC, max. 18 W (12 – 70 VDC with ext. power supply)

analogue rate of turn output .....1 ±0.1-999.9 mV/°/min, settable; max. 10V, 10 mA

voyage data printer output .....1 act. heading, rudder angles, date, time, heading reference, steering mode, speed, position

Alarm and Status Outputs

power failure / general device error alarm ..... potential-free contact; max. 30W, 1A; 125 V

AC power supply ..... potential-free contact; max. 30W, 1A; 125 V

AC power supply ..... potential-free contact; max. 30W, 1A; 125 V

heading reference status (G1/G2/Mag) ..... potential-free contact; max. 30W, 1A; 125 V

heading difference alarm ..... potential-free contact; max. 30W, 1A; 125 V

max ROT alarm..... potential-free contact; max. 30W, 1A; 125 V

watch alarm trigger output ..... potential-free contact; max. 30W, 1A; 125 V

Data and Signal Inputs

magnetic heading ..... fluxgate sensor, sin/cos type or electronic compass, NMEA 0183 or PLATH-format

heading gyro 2 ..... NMEA 0183, PLATH-format, Lehmkuhl LR 20 or LR 40

position..... NMEA 0183

speed ..... NMEA 0183 or 200 pulses/nm

rudder angle..... 2 independent rudder angles, analogue (feedback. potentiometer)

steering mode ..... sel. switch status

heading reference ext. (Gyro/Mag;G1/G2) ..... sel. switch status

time const. ROT ..... sel. switch status

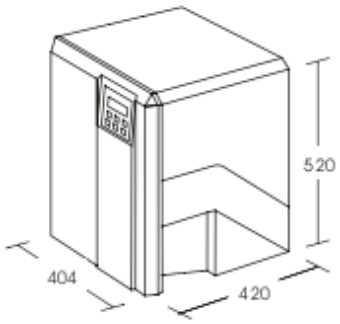
ext. alarm acknowledge ..... sel. switch status

Dimensions and Weight

width..... 404 mm

height ..... 520 mm

depth.....420mm
front plate control unit ..... 96 x96 mm
weight..... 25 kg



3.3 Operation

Power-up Sequence

Energize the gyrocompass system.

1) The control and display unit performs self-test and takes up operation.
2) The control and display unit displays the masterboard status message.
3) The gyrocompass system enters normal operational mode. The startup screen is displayed, showing heading data from the connected compasses and the heading difference alarm threshold.

Heading Reference Source Selection

From the startup screen, the operator may select one of the available heading sources as the reference for the devices connected to the gyrocompass system (e.g. autopilot, repeaters etc.).

Internal Selection (standard)

SHIFT + F1 MENU Press keys simultaneously to select gyro 1.

SHIFT + F2 1 Press keys simultaneously to select gyro 2 (if available).

SHIFT + F3 1 Press keys simultaneously to select magnetic compass (if available).

External Selection (optional)

Use the external selector switch to select the heading reference.

Note: Heading reference selection is permitted in manual steering mode only. If steering in autopilot mode, source selection is disabled.

Display Illumination

ENTER / DIM + Press key. The display becomes brighter.

RESET / DIM – Press key. The display becomes darker.

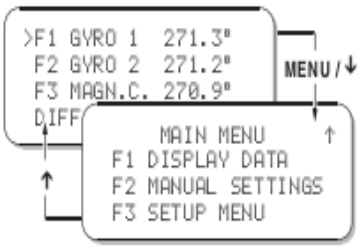
Confirm Alarm / Mute Alarm Buzzer

SHIFT + F1 / MENU On alarm, press keys to confirm the alarm and clear the alarm message from the display screen. The alarm buzzer is muted simultaneously. If the cause of an alarm is eliminated, a pending alarm message is automatically cleared from the display and the buzzer muted.

SHIFT + RESET / DIM – On alarm, press keys to mute the alarm buzzer.

Menu Operation

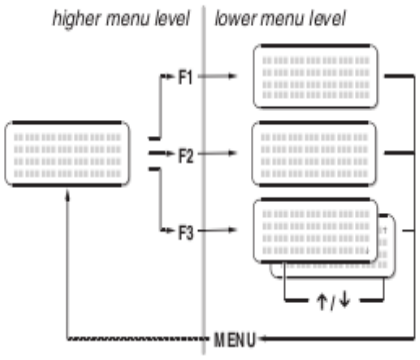
The data display screens and the manual settings, user and service setup modes are accessible via a multilevel operating menu.



entering / quitting the main menu

F1 / MENU / F3 / I from startup screen, press to go to main menu screen.

F2 / I from main menu screen, press to return to startup screen.



navigating the menu

SHIFT F1 MENU
SHIFT F2 I
SHIFT F3 I
} go to sub-menu

F1 MENU — return to next higher menu level

F3 I / F2 I — go to next/previous screen on same menu level

selecting parameter settings

flashing arrows: selection expected

F2 I / F3 I — show next/previous option

SHIFT ENTER DIM+ — select option and go to next line

entering data

flashing cursor: data input expected

F2 I / F3 I — increase/decrease input value

ENTER DIM+ / RESET DIM− — move cursor forward/back

SHIFT ENTER DIM+ — confirm input and go to next line

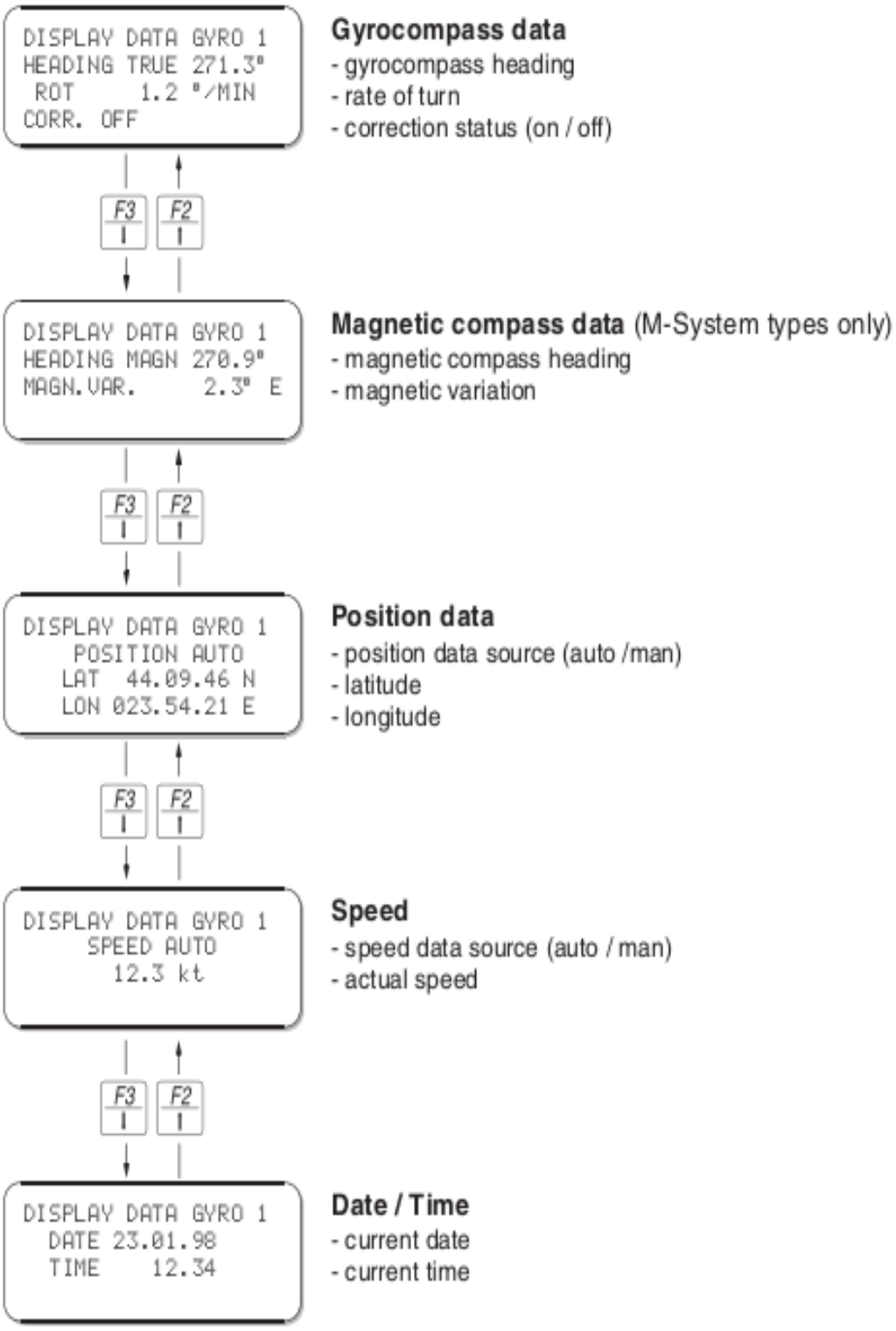
SHIFT RESET DIM− — clear input (value is set to zero)

Menu Structure

Display Data Selection

The "Display Data" menu provides access to the data display screens. The selected display screen remains active until the user selects a different screen or quits the display data menu.

Display data screens



Optional Functions (available if relevant equipment installed)
Ext. Alarm Acknowledge

Mutes the alarm buzzer from a remote facility (e.g. a central alarm panel). The alarm message remains on the display screen until the alarm is confirmed.

Turn Heading Display 180°

Turns the heading display by 180° (e.g. for operation in ferries). Actuated by external selector switch.

Analogue Rate of Turn Display Damping

Turns damping of the analogue rate of turn output on/off. Actuated by external selector switch.

Watch Alarm Trigger Output

Activates the watch alarm trigger relais for 100 msec. Actuated by pressing any key on the control and display unit.

North Speed Error Correction

The NAVIGAT X Mk 1 gyrocompass system provides automatic correction of the north speed error. If correction is active, the system permanently calculates the north speed error from the current speed and position and corrects the gyrocompass heading data accordingly.

The north speed error δ arises from the combination of the ship's speed with the rotation of the earth. Depending upon the latitude and the vessel's speed and direction, the heading indicated by an uncorrected gyrocompass deviates from the true heading by the north speed error δ.

The mathematical formula for the north speed error δ is:

$$\sin \delta = -\left(\frac{v \cdot \cos \text{hdg.}}{904 \cdot \cos \varphi}\right)$$

where: v = speed (kts.)
ϕ = latitude
904 = rotational speed of the earth (kts.)

As a reference, a set of error tables is provided at the back of this manual which give the north speed error δ of an uncorrected gyrocompass at different headings, speeds and latitudes.

3.4 Maintenance

Maintenance Specifications

All maintenance work is to be carried out by an authorized C. PLATH service station, unless otherwise stated.

Following any maintenance work, the complete gyrocompass system is to be function checked.

Annual Maintenance

C. PLATH recommends that annually the gyrosphere container be opened, its internal surfaces and the gyrosphere be cleaned and the mercury, insulating fluid and supporting fluid be renewed. If necessary, the centering pin is to be renewed.

Five-Year Maintenance

C. PLATH recommends that at intervals of a maximum of five years, the gyrosphere and the centering pin be renewed.

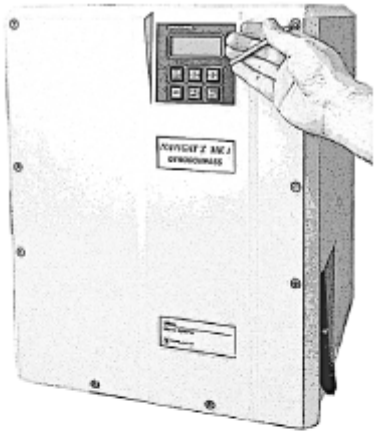
Maintenance by Shipboard Personnel

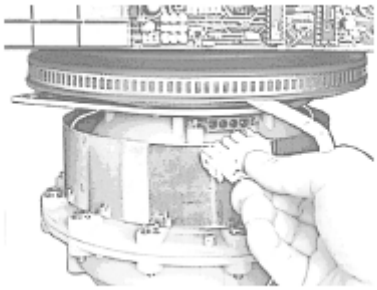
Removal of the Gyrosphere Container at Low Ambient Temperatures

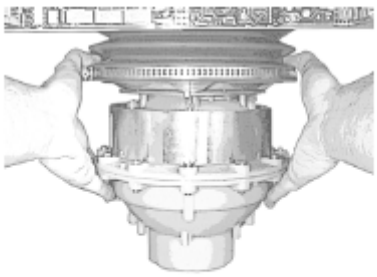
At ambient temperatures below 0 ° C when the gyrocompass is not in operation, and below -10 ° C when the gyrocompass is in operation, the gyrosphere container is to be removed from the compass housing and stored at a place where the ambient temperature will not fall below 0 ° C.
If no storage place is available where the ambient temperature will not fall below 0 ° C, the gyrosphere is to be removed from the gyrosphere container to prevent damage caused by frozen supporting fluid. The gyrosphere may be removed only by personnel of a C. PLATH-authorized service station.

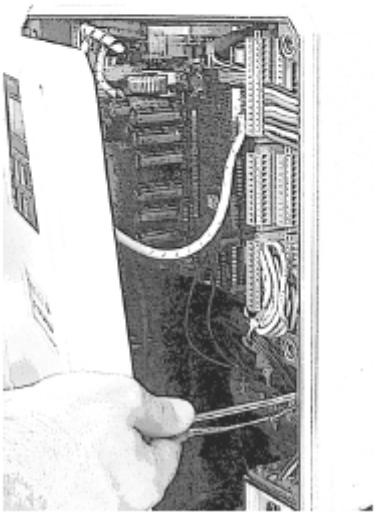
1) De-energize the gyrocompass system.
2) Wait at least 45 minutes for the gyrocopes to stop rotating.
3) Unscrew the retaining screws of the compass housing door and take the door off the housing.
4) Disconnect the grounding strap between door and housing. If the control and display unit is mounted in the door, unplug the unit's connector from the masterboard (plug connector J3).
5) Place the door aside.
6) Disconnect the plug from the socket on the gyrosphere container.
7) Put both hands around the gyrosphere container, placing the thumbs on the rim of the bellows.
8) Press together bellows and gyrosphere container. With the thumbs, turn the bellows to the right until the bayonet coupling disengages.
9) Lift the gyrosphere container out of the compass housing and carefully transport it

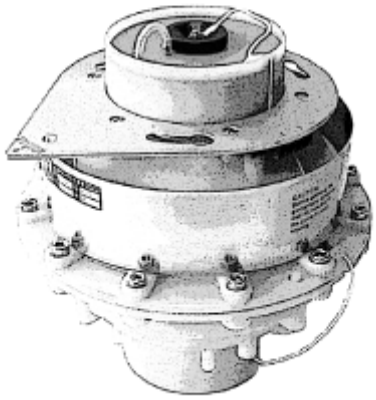
to a suitable storage place.
10) Fit the door back on the compass housing and secure it with the retaining screws.











Maintenance by Service Personnel

Gyrosphere Handling and Storage Instructions

The gyrosphere is contained in a shockproof box, which is packed in a transport container. This transport container is completely suitable for transport by air, sea, rail and road. The gyrosphere is always to be stored in its original transport container.

The storage temperature is to be between -25 ° C and +70 ° C. The humidity in the storage room is to be between 60% and 90%.

The period of storage before the gyrosphere is taken into operation is not to exceed 12 months. Gyrospheres stored longer than 12 months before being taken into operation are to be tested by an authorized C. PLATH service station before installation.

Caution:
The gyrosphere is always to be transported in an original transport container.
Do not throw or drop the transport container.
The transport container is to be transported in an upright position only.

Upon installation, the gyrosphere is to be removed from the transport container in its shockproof box and is to be carried by hand directly to the place of installation.

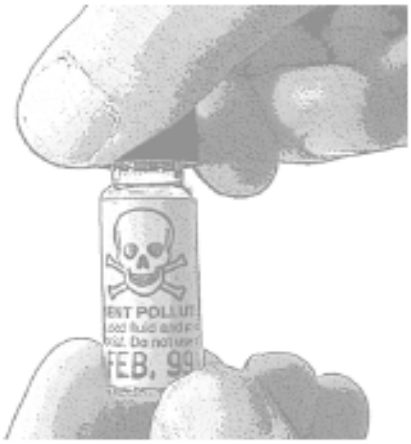
Caution:
The shockproof box containing the gyrosphere is only to be transported by hand, and is to be handled with extreme care.

Safety Warning

Installation and removal of the gyrosphere includes the handling of mercury.

The mercury together with insulating fluid is contained in a phial enclosed in a sealed box in the installation and replacement parts kit.

Warning:
Spilt mercury will evaporate and give off poisonous fumes.



Spilt mercury is to be gathered up with the syringe provided in the installation and replacement parts kit and sealed in an empty phial.

After installation of the gyrosphere, keep the empty phial in its box in the installation and replacement parts kit. After removal of the gyrosphere, return the phial with the used mercury and insulating fluid to C. PLATH for recycling.

Installation of the Gyrosphere

Note: At the place of installation, a clean and level work surface must be available.

In addition to the parts provided in the installation and replacement parts kit, a 5 mm hexagon key, a medium-sized and a small screwdirver will be needed during the installation.
For cleaning purposes, a lint-free cloth and alcohol are required.

Caution: Do not use acetone or similar solvents.

1) De-energize the gyrocompass system.

2) Remove the gyrosphere container from its transport box and place it on the work surface.

3) Unscrew the centering pin and place it aside (do not yet remove the protective cap from the pin).

4) Disconnect and remove the plug connector from the base contact.

5) Unscrew the captive screws attaching the two halves of the gyroshere container.

6) Remove the upper section of the gyrosphere container and place it upside down on the work surface.

Caution: Do not damage the golden contact pins.

7) Open the gyrosphere transport box, remove the top foam rubber pad and place it with the recess uppermost on the work surface.

8) Remove the gyrosphere from the transport box and place it in the foam rubber pad.

9) Take the plastic bowl from the replacement parts kit and place it on the work surface.

10) Remove the protective sticker from the recess of the gyroshere. Placing a thumb in the recess, lift the gyrosphere out of the foam rubber pad and place it on the plastic bowl.

11) Carefully wash the gyrosphere with alcohol and dry it with a lint-free cloth.

Caution: do not use acetone or similar solvents.

12) Rinse the gyrosphere with fresh supporting fluid.

Caution: The recess of the gyrosphere must be kept absolutely clean and dry. Do not use compressed air to dry the gyrosphere.

13) Take the box containing the phial of mercury and insulating fluid from the installation and replacement parts kit. Remove the phial from the box.

Warning: Spilt mercury will evaporate and give off poisonous fumes.

Spilt mercury is to be gathered up with the syringe provided in the installation and replacement parts kit and sealed in an empty phial.

14) Open the phial and pour the entire contents into the recess of the gyrosphere.

The mercury is to form a single drop at the bottom of the recess.

If necessary, take the syringe and cannula from the installation kit and gather the mercury in a single drop by gently pressing on it with the tip of the cannula.

15) Close the empty phial and put it back in its box. The phial is to be kept in the installation kit and will be needed to take up used mercury and insulating fluid during the removal of the gyrosphere.

16) Carefully fill up the recess of the gyrosphere with supporting fluid.

17) Rinse the inside of the lower section of the gyrosphere container with supporting fluid.
18) Check that the drain plug is tightened firmly. Pour some supporting fluid into the gyrosphere container until the base contact is covered by the fluid.
19) Check that the quad ring lies correctly in its groove in the lower section of the gyrosphere container.
Caution: When replacing a gyrosphere, always use a new quad ring.
20) Carefully remove the gyrosphere from the plastic bowl and place it into the container.
21) Rinse the inside of the upper section of the gyrosphere container with suppurting fluid.
22) Carefully fit the upper part of the gyrosphere container to the lower part. The golden contact pins fit into grooves in the lower part of the container.
23) Tighten the captive screws in a series of diagonal opposites.
24) Remove the outer end of the ventilation valve from its neck.
25) Fit the funnel into the hole for the centering pin. Fill up the gyrosphere container with supporting fluid until excess fluid exits from the valve neck. Remove the funnel from the gyrosphere container.
26) Take off the protective cap from the centering pin and rinse the pin thoroughly with supporting fluid.
27) Screw in the centering pin and tighten it firmly by hand.
28) Draw up some supporting fluid with the syringe and inject it into the open end of the ventilation valve until the remaining air has exited the container (remaining air is visible through the translucent top of the container). Gently tilt the container, if necessary.
29) Attach the free end of the ventilation valve to its neck.
30) Carefully dry the gyrosphere container with a lint-free cloth.
31) Connect the power cable to the centering pin and firmly tighten the terminal screw.
32) Insert the base plug connector through the hole in the lower section of the container. Lift the container to the shoulder, keeping it in a vertical position. Connect the plug to the base contact.
33) Place the container back on the work surface.
34) If replacing a gyrosphere, place the provided label with the new gyrosphere's serial number on the magnetic shield of the gyrosphere container.
34) Unscrew the retaining screws of the compass housing door and take off the door from the housing
35) Disconnect the grounding strap between door and housing. If the operating and control unit is mounted in the door, disconnect the unit from the masterboard (plug connector J3). Place the door aside.
36) Gently turn the bellows, until the rubber tongue points towards the front of the housing.
37) Place the gyrosphere container into the compass housing with the pointer

located directly below the tongue of the bellows.

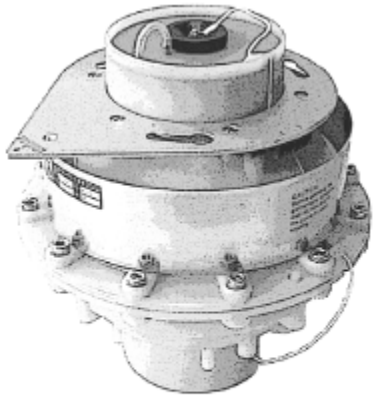
38) Put both hands around the container and lift it into the bellows. Turn the container to the left until the coupling engages.

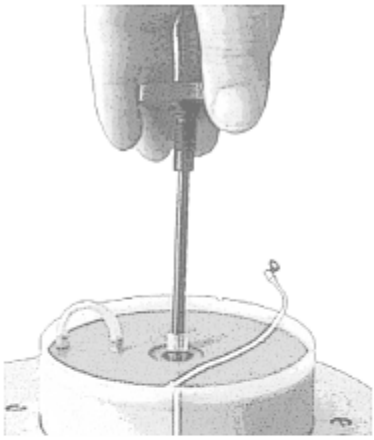
39) While supporting the countainer with the palms, put the thumbs on the rim of the bellows and press together bellows and container. With the thumbs, turn the bellows to the left to lock the coupling.

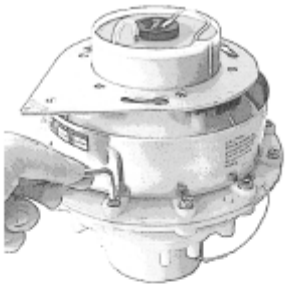
40) Connect the plug to the socket on the gyrosphere container.

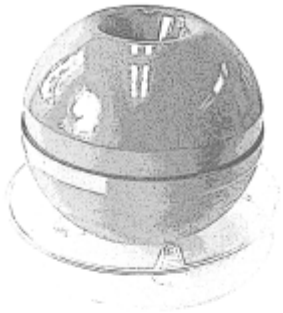
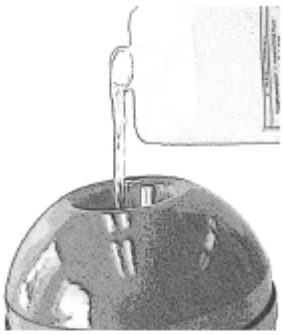
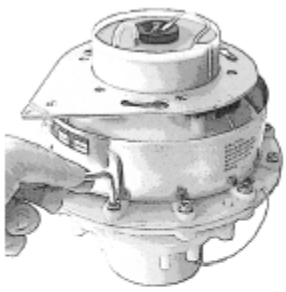
41) Put the door in front of the housing and connect the grounding strap. Connect the control and display unit to the masterboard (plug connector J3).

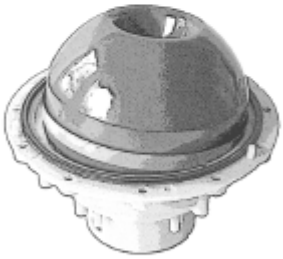
42) Fit the door on the housing and tighten the retaining screws.

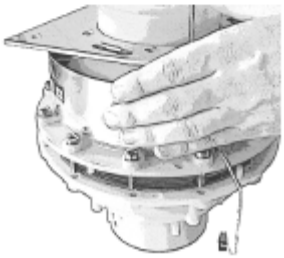


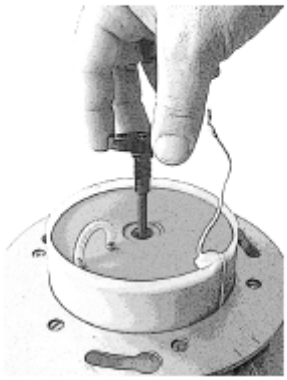


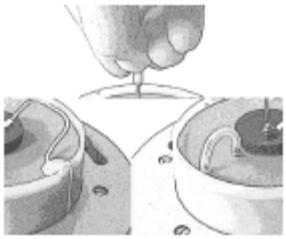


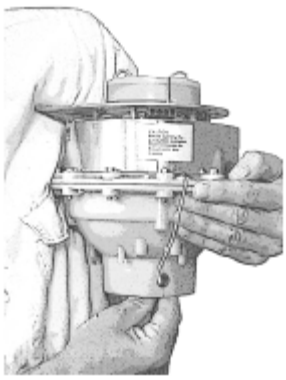




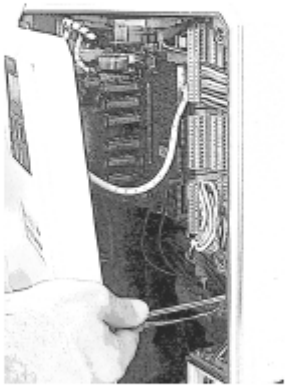


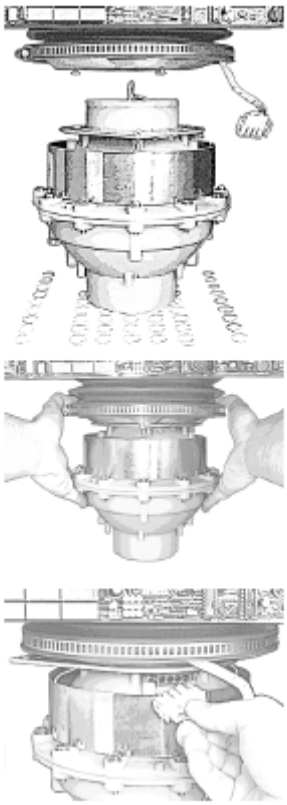












Function test

1) Energize the gyrocompass system.

2) In the service setup 2, select the gyrosphere data sub-menu.

Observe the gyrosphere current:

Directly after power-up, the gyrosphere current should not exceed 550 mA.
The current will gradually fall while the gyrosphere settles.
Within 45 minutes after power-up, the gyrosphere current must have dropped below 300 mA.

GYROSPHERE DATA
TEMPERATURE 40 °C
PH.BRIDGE
GYRO CURR 234 mA
After initial power-up, gyrosphere current must drop below 300 mA within 45 minutes.

If, after 45 minutes of operation, a gyrosphere current above 300 mA is displayed in the gyrosphere data sub-menu, measure the AC-voltage present across resistor R150 (1Ω) on the masterboard. The voltage across R150 in mV equals the gyrosphere current in mA.

Caution:

If 45 minutes after power up, the gyrosphere current has not dropped below 300 mA, the gyrosphere is defective and must be replaced.

Removal of the Gyrosphere

1) De-energize the gyrocompass system.
2) Wait at least 45 minutes for the gyro scopes to stop rotating.
3) Unscrew the retaining screws of the compass housing door and take the door off the housing.
4) Disconnect the grounding strap between door and housing. If the control and display unit is mounted in the door, unplug the unit's connector from the masterboard (plug connector J3).
5) Place the door aside.
6) Disconnect the plug from the socket on the gyrosphere container.
7) Put both hands around the gyrosphere container, placing the thumbs on the rim of the bellows.
8) Press together bellows and gyrosphere container. With the thumbs, turn the bellows to the right until the bayonet coupling disengages.
9) Take the gyrosphere container out of the compass housing and lift it to the shoulder, keeping it in a vertical position. Disconnect the plug connector from to the base contact and pull the cable through the hole in the lower section of the container.
10) Place the container on the work surface
11) Take the plastic bowl from the installation and replacement parts kit and place it under the drain plug of the gyrosphere container.
12) Unscrew the terminal screw in the centering pin. Remove the contact from the pin and tighten the screw.
13) Unscrew the centering pin and remove it from the gyrosphere container.
14) Wash and dry the centering pin. Put the protective cap on the tip of the pin.
15) Unscrew the drain plug and let the supporting fluid run into the bowl.
Screw in and tighten the drain plug.
16) Unscrew the captive screws attaching the two sections of the gyrosphere container.
17) Remove the upper section of the gyrosphere container and place it upside down on the work surface.
Caution: Do not damage the golden contact pins.
18) Take the box containing the phial of mercury and insulating fluid from the

installation and replacement parts kit. Remove the phial from the box and open it.

Warning: Spilt mercury will evaporate and give off poisonous fumes.
Spilt mercury is to be gathered up with the syringe provided in the installation and replacement parts kit and sealed in an empty phial.

19) Insert the syringe with the cannula into the recess of the gyrosphere. Draw up the mercury and insulating fluid completely.

20) Inject the mercury and insulating fluid into the empty phial.

21) Placing a thumb in the recess of the gyrosphere, lift the gyrosphere out of the container and pour the remaining supporting fluid from the recess into the plastic bowl.

22) Place the gyrosphere back into the lower section of the gyrosphere container.

23) If there is any mercury left in the plastic bowl, take it up with the syringe and inject it into the phial.

24) Close the phial and put it back into the box.

25) Return the box with the phial to C. PLATH for recycling.

Note: Used mercury and insulating fluid may not be reused. When replacing the gyrosphere, always use fresh mercury and insulating fluid.

26) Discard the supporting fluid from the plastic bowl.

Note: The supporting fluid is not poisonous.

27) Placing a thumb in the recess of the gyrosphere, lift the gyrosphere out of the gyrosphere container and place it in the plastic bowl.

28) Using a lint-free cloth and alcohol, carefully wash and dry the gyrosphere.

Caution: Do not use acetone or similar solvents.

29) Thoroughly clean the contact surfaces of the gyrosphere with the stainless steel wool pad provided in the installation and replacement parts kit.

30) Seal the recess of the gyrosphere with a protective sticker. Stickers are included in the installation and replacement parts kit and with replacement gyrospheres.

31) Pack the gyrosphere in its shockproof box and pack the box in the original transport container.

32) Discard the remaining supporting fluid from the lower section of the gyrosphere container.

33) Using a lint-free cloth and alcohol, thoroughly wash and dry the inside of the gyrosphere container.

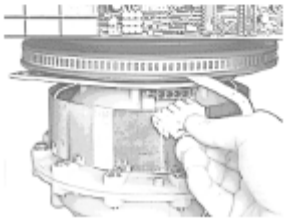
34) Carefully fit the upper section of the gyrosphere container to the lower section. The golden contact pins fit into grooves in the lower section of the container.

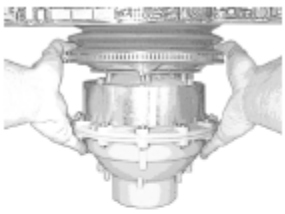
35) Tighten the captive screws in a series of diagonal opposites.

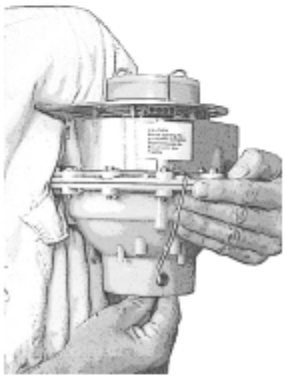
36) Screw in the cetering pin and tighten it firmly by hand.

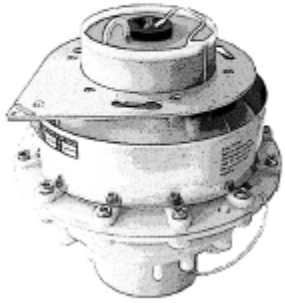
37) Pack the gyrosphere container in its original transport box.

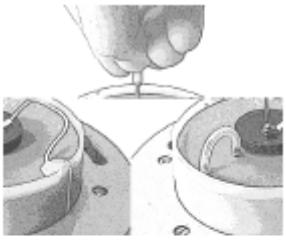
38) Fit the door back on the compass housing and secure it with the retaining screws.

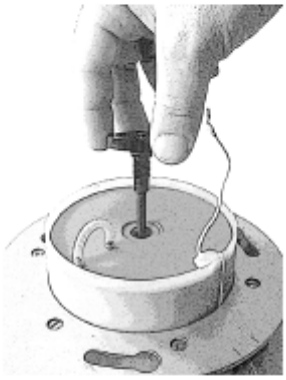


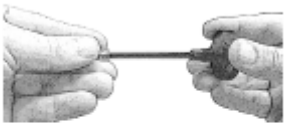


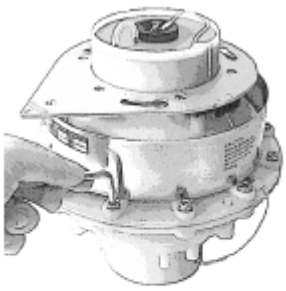


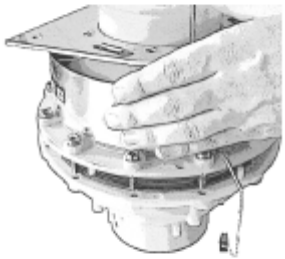












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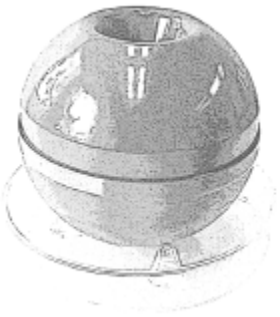
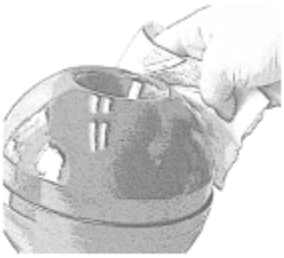
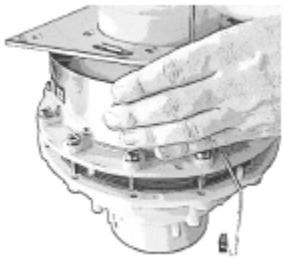
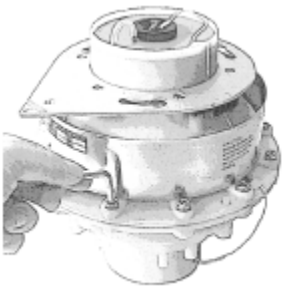








4 TG-6000

4.1 System overview

The gyrocompass TG-6000 has been designed on the basis of the gyrocompass TG-5000 which have been used on more than 5000 vessels for aiming at further fullness of input-output signal lines and compactness. It has the following features.

(1) Automatic speed error correction function
(2) Digital signal processing
(3) Long service life
(4) Low power consumption
(5) Comply with IMO standards

1-2 Configuration

This gyrocompass consists of following 2 units and a spare box.

Master compass x 1
Control box (Operating Panel) x 1
Spare box x 1

For shipment, the sensitive element in the master compass is packaged separately.
Refer to drawings in Section 7 for external dimensions of units.

NOTE

When assembling in the pilot steering stand (built in pilot), the master compass and each unit of the control box are assembled in the steering stand and the sensitive element only is packaged separately.

4.2 Technical data

Specifications

Accuracy

(lat. = latitude)

(1) Settling time Within 4 hours(at lat. 35° when starting from deviation angle within 30°) Within 2 hours(at lat. 35° when starting from deviation angle within 5")
(2) Settle point error ±0.3° X Sec.lat.
(3) Standard deviation 0.1° X Sec.lat.
(4) Repeatability ±0.2° X Sec.lat.
(5) Roll and pitch error ±0.5° X Sec.lat.
(6) Accuracy for environmental change ±0.5° X Sec.lat.
(7) Speed error correction accuracy ±0.2° X Sec.lat.

General specifications

(1) Repeater type Step-motor type (DC 24V 1/6°) DC 24V 0.7A for one repeater circuit
(2) Number of repeaters connected 9 circuits(also possible to connect load

of max. DC 24 V 8.5 A)

(3) Follow up rate (master compass) 24° / sec (360° 115 sec)

(4) Angular freedom of gimbal ± 45° for roll and pitch

(5) Latitude error correction Automatic (N/S 0° to 70°)

(6) Speed error correction Automatic
(200 pulses/ nm is input)
(GPS input)
or manual
0 to 50 knot settable Only repeater compasses are corrected.

(7) Speed input signal Pulse signal (200 pulses/nm dry contact point)

(8) Main power supply Master compass
AC 100/220 V 50/60 Hz
For starting 140 VA
For normal running 70 VA
For one repeater compass circuit
DC 24 V 0.7 A

(9) Emergency power supply DC 24 V
For starting 140W
For normal running 70 W supply

(10) Voltage fluctuation AC power -10% to +10% supply
DC power -20% to +30% supply

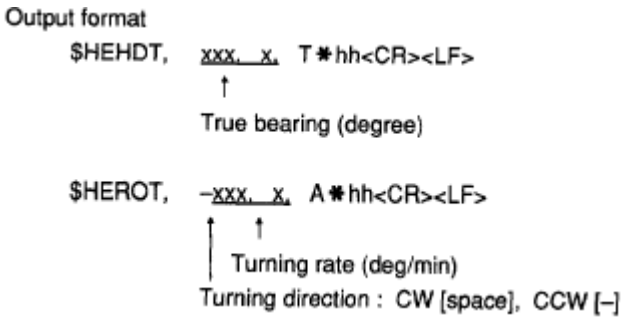
(11) Frequency fluctuation AC power -5% to + 5%

(12) Ambient temperature -10°C to +50°C (in use)

Special specification (option)

(1) Repeater backup signal
DC 24 V 1/6° step
3 circuits max. 2.5 A

(2) Digital output-1
Serial signal 2 circuits
Electrical specification: RS422/NMEA0183 (selectable)
Baud rate: 4800 bps
Data length: 8 bits
Parity: None
Stop bit: 1 bit
Transmission rate: 1 sec



NOTE

When GPS alarm generates, the true bearing data are not output and two commas (,) follow to the header ($ HEHDT).

(3) Digital output-2

Serial signal 4 circuits

Electrical specification: RS422

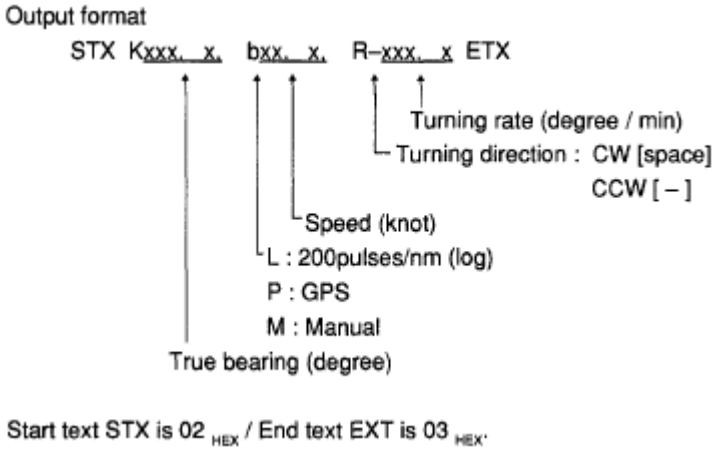
Baud rate: 9600bps

Data length: 8 bits

Parity: None

Stop bit: 1 bit

Transmission rate: 50 msec


Output format
STX Kxxx. x, bxx. x, R–xxx. x ETX
Turning rate (degree / min)
Turning direction : CW [space]
CCW [–]
Speed (knot)
L : 200pulses/nm (log)
P : GPS
M : Manual
True bearing (degree)
Start text STX is 02 HEX / End text EXT is 03 HEX.

NOTE

CW turn CCW turn CW turn CCW turn

When GPS alarm generates, the true bearing data are not output, and a comma (,) follows to the header (STXK). No speed data are also output, and a comma follows to the header (P) which expresses the ship speed system.

(4) Analog output-1

Turn rate 3 circuits

① -5 to +5 V (±30° / min) +： CW turn
—： CCW turn

② -10 to+10 V (120°/min) +： CW turn
—： CCW turn

(5) Analog output-2

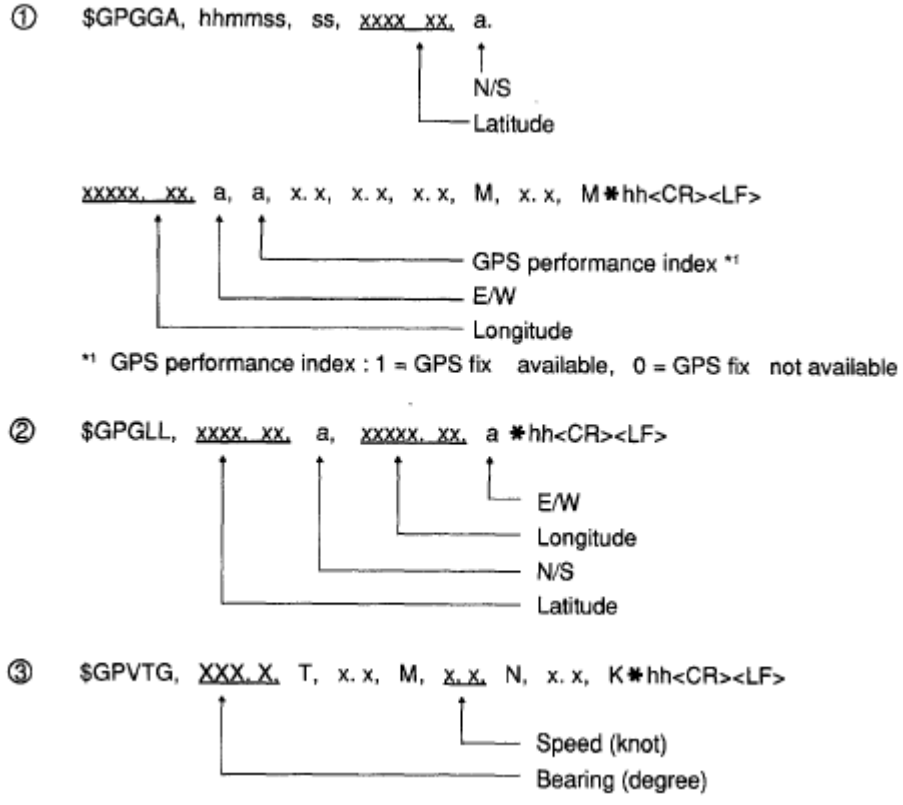
Turn rate scale over 3 circuits

① ±30° / min or more ±5 V +：CW turn
—：CCW turn

② ±120° / min or more ±5 V +：CW turn
—：CCW turn

(6) GPS input signal (for latitude, speed signals)
Serial signal 1 circuit
Electrical specification：RS422/NMEA0183 (selectable)
Baund rate: 2400, 4800, 9600 bps (selectable)
Data length: 5, 6, 7, 8 bits (selectable)
Parity: None, even, odd (selectable)
Stop bit: 1,1.5, 2 bits (selectable)
Transmission rate: 0.5,1, 2 sec (selectable)

Input format


① $GPGGA, hhmmss, ss, xxxx. xx, a.
N/S
Latitude
xxxxx. xx, a, a, x.x, x.x, x.x, M, x.x, M*hh<CR><LF>
GPS performance index *1
E/W
Longitude
*1 GPS performance index : 1 = GPS fix available, 0 = GPS fix not available
② $GPGLL, xxxx. xx, a, xxxxx. xx, a *hh<CR><LF>
E/W
Longitude
N/S
Latitude
③ $GPVTG, XXX.X, T, x.x, M, x.x, N, x.x, K*hh<CR><LF>
Speed (knot)
Bearing (degree)

(7) Repeater output circuit
It is possible to increase 6 circuits with additional circuits.

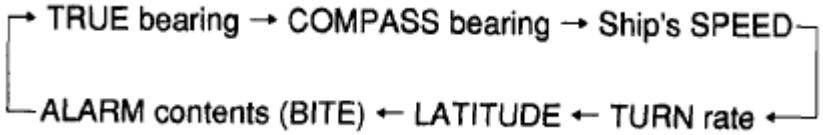
4.3 Operation

Explanation for Gyro Operating Panel
For the position of the control box operating panel and detail of the operating panel, refer to [Fig. 2- 1 Control Box and Operating Panel] attached to the end of this

section. For the master compass, refer to attached [Fig. 2-2 Master Compass],

① POWER supply switch： Switch to start and to stop this system.
Turning [ON] starts the master compass.

②DISPLAY (DISP) switch : Switch to select display item and display data.
Pressing this switch scrolls the display item LED © and display data as follows.
Pressing this switch with pressing the ENT switch © scrolls the display item LED and display data reversely.



③ SET switch：Switch to change display data and input system. Display data can be changed at the following display items.
Master bearing (COMPASS)
Ship's speed (SPEED)
Latitude (LATITUDE)
Input system can be changed at the following display items.
Ship's SPEED (Log/GPS/Manual)
LATITUDE (Gyro/GPS)

④ Data change and input system selection switch.
Dimmer switch(DIM, [-][+])：Switch to change display data and to select input system. This switch is used to adjust illumination of the operating panel other than when setting.
+ : brightens illumination
- : darkens illumination

⑤ Input switch (ENT) : Switch to fix changed data (system) when changing display data and input system.

⑥ LAMP TEST switch：Switch to check LED by lighting all LEDs.

⑦ ALARM ACK switch：Switch to stop the alarm buzzer

⑧ ALARM LED：LED to indicate alarm conditions, and operates as follows.
when alarm generates：Blinks
When alarm condition continues after ALARM ACK
switch ⑦is pressed：Continuous lighting
When alarm condition is released after ALARM ACK
swtich is pressed : Goes off

⑨ Display：The following values are displayed with 4 digits 7 segments.

1 TRUE bearing
2 COMPASS bearing :
3 Ship's SPEED :
4 TURN rate
5 LATITUDE

6 BITE (ALARM contents) ： Displays alarm contents generated in the gyrocompass with error code.

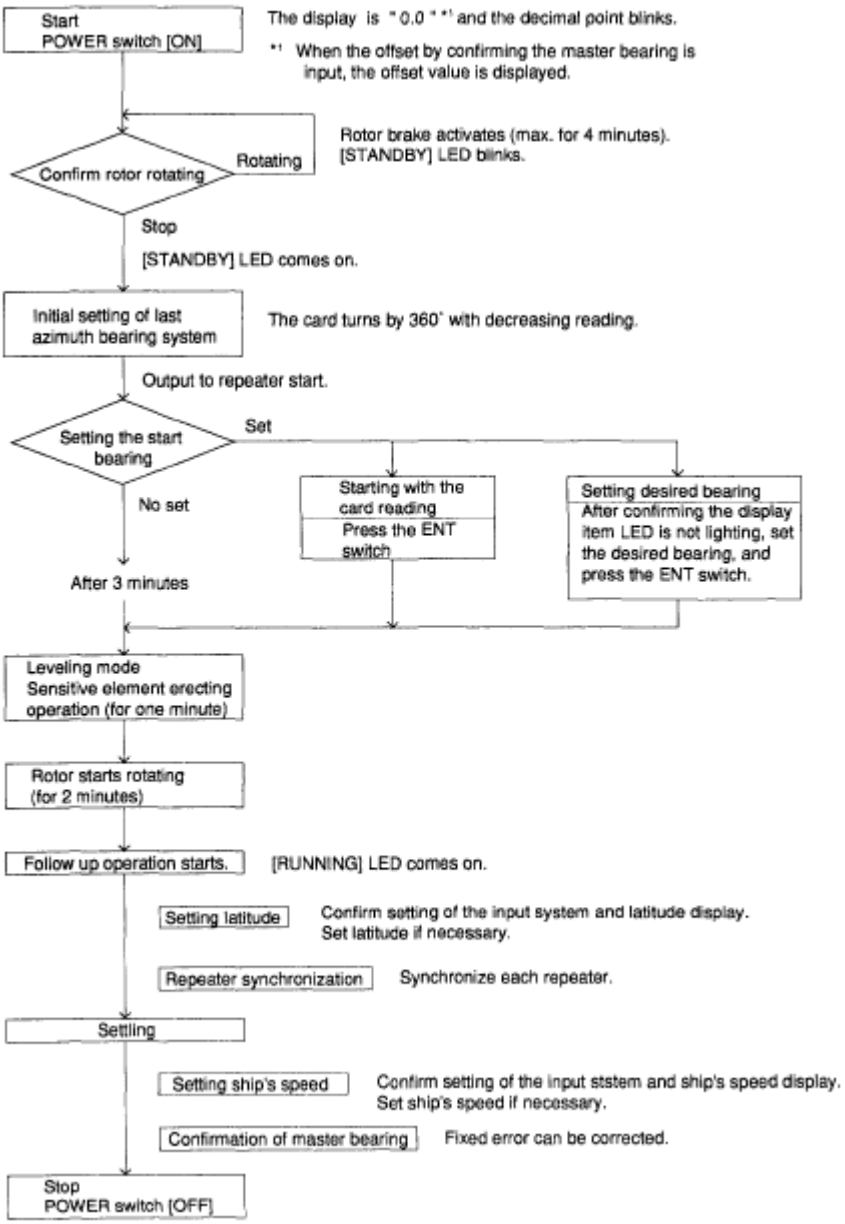
⑩ Display item LED : LED to indicate contents of data indicated on the display.

⑪ Mode LED：LEDs to indicate the master compass running condition.

RUNNING lighting : Displays running condition.
STANDBY lighting : Displays standby condition.
STANDBY blinking : Indicates the rotor is being braked.

⑫ Master compass card illumination switch：Switch for illumination adjustment of the card indication. Provided at the lower part of the master compass. Switch positions are [Bright], [off] and [Dark].

Start • Stop Sequence
The TG-6000 gyrocompass operates in the sequence shown below.
For each operating method, refer to clauses "2-3 Start • Running" and "2-4 Stop".


Start
POWER switch [ON]
The display is " 0.0 " *1 and the decimal point blinks.
*1 When the offset by confirming the master bearing is input, the offset value is displayed.
Confirm rotor rotating
Rotating
Rotor brake activates (max. for 4 minutes).
[STANDBY] LED blinks.
Stop
[STANDBY] LED comes on.
Initial setting of last azimuth bearing system
The card turns by 360° with decreasing reading.
Output to repeater start.
Setting the start bearing
Set
No set
After 3 minutes
Starting with the card reading
Press the ENT switch
Setting desired bearing
After confirming the display item LED is not lighting, set the desired bearing, and press the ENT switch.
Leveling mode
Sensitive element erecting operation (for one minute)
Rotor starts rotating (for 2 minutes)
Follow up operation starts.
[RUNNING] LED comes on.
Setting latitude
Confirm setting of the input system and latitude display.
Set latitude if necessary.
Repeater synchronization
Synchronize each repeater.
Settling
Setting ship's speed
Confirm setting of the input ststem and ship's speed display.
Set ship's speed if necessary.
Confirmation of master bearing
Fixed error can be corrected.
Stop
POWER switch [OFF]

Start • Running 2-3.1 Start

(1) POWER turned ON

Turn [ON] the POWER supply switch(1)on the operating panel.

At that time, if the rotor is stopping, the [STANDBY] LED of Mode LED (11) comes on. When the rotor is rotating, the [STAND BY] LED of Mode LED (11） blinks and stops the rotor once (for max. 4 minutes).

After the POWER turned ON and confirming the rotor stop, the card turns by 360° with decreasing reading.

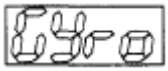
(2) Setting the start bearing

After the card turns by 360° with decreasing reading, set the start bearing. Confirm that all display item LEDs are not lighting *1 and press the SET switch(3). Set the desired start bearing *2 with the data change (DIM [-][+]) switch ©during the display data are blinking, and fix the value with the ENT switch(5). At this time, the

display item LED lights at the true bearing position. After that, the system enters the leveling mode (erecting operation).
*1 When any of the display item LEDs (10) is lighting, press the DISP switch (2) until all display item LEDs go out, and set the start bearing.
*2 When starting with the bearing displayed in the display (9) after turning the card by 360" with decreasing reading, setting the start bearing is not necessary. Press, however, the ENT switch (5).
If the ENT switch is not pressed, the system automatically moves to the next sequence after 3 minutes.
After three minutes from setting of the start bearing, the system starts follow-up operation. At this time, [RUNNING] of the mode LED (11) comes on.
(3) Setting the latitude input system
Press the DISP switch (2) to set the display item LED (10) at the LATITUDE. Press the SET switch(3) and select [GPS] or [GYRO] with the data change switch(4) * and fix it by pressing the ENT switch (5) . When the [GYRO] is selected, the numeric value is displayed in the display. Set the latitude with the data change switch (4) and press the ENT switch again. The latitude is displayed by [degree, minute], and the decimal point blinks for the south latitude.
*6 Display when the latitude input system is set
When the latitude input system is set, indications of the display are as follows.

[GPS] :

(The latitude obtained by GPS is displayed after fixing.)

[GYRO]: 

(The value blinks after fixing. Set the latitude with the data change switch (4) and press the ENT switch again. After that, the latitude calculated with the ship's speed and true bearing is displayed.)

When no input from GPS and the latitude input system is set at GPS, the alarm and error code E-c (refer to "2-3.3 alarm") generate.
CAUTION
A large changing of the latitude setting causes a large changing of the true bearing. Be fully careful that this causes a large course changing during auto steering.
NOTE
When alarm GPS (error code E-c or E-d display) generates, change the set of the ship's speed / latitude input system, and set the display item LED (10) at the true bearing (TRUE) with the DISP switch (2).
Then, fix the blinking bearing by pressing the ENT switch(5)
NOTE
Be sure to press the ENT switch (5) after finishing setting. The changed setting is not accepted if the ENT switch is not pressed after finishing setting.
(4) Synchronization of repeater compass

The repeater signal is output after finishing the last azimuth (bearing system initial setting). Set each repeater reading at the true bearing value [TRUE].

(5) Setting

The gyrocompass will settle in approx..2 hours when starting with the deviation angle of within 5° . Even with a large deviation angle, it will settle within 4 hours.

(6) Setting the ship's speed input system

Press the display switch (2) to set the display item LED (10) at the [SPEED], Press the SET switch (3) and select [LOG], [GPS] or [MANUAL] with the data change switch (4) *3, and fix the data by pressing the ENT switch (5) *4.

When selecting [MANUAL] *5, the numeric value is displayed in the display. Set the ship's speed with the data change switch (4) and fix the data by pressing the ENT switch again. When no input from GPS and the latitude input system is set at GPS, the alarm and error code E-c (refer to" 2-3.3 alarm ") generate.

When no input from LOG and the latitude input system is set at [LOG], the ship's speed data are treated as 0 knot.

CAUTION

A large changing of the latitude setting causes a large changing of the true bearing. Be fully careful that this causes a large course changing during auto steering.

NOTE

When GPS alarm (error code E-c or E-d display) generates, change the set of the ship's speed / latitude input system, and set the display item LED (10) at the true bearing (TRUE) with the DISP switch(2).

Then, fix the blinking bearing by pressing the ENT switch (5).

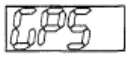
NOTE

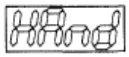
The ship's speed setting (the value too when [MANUAL]) is stored, and when restarting, the operation starts with the previously set value. When [MANUAL] is selected and the power is cut after stopping the ship, set the value at 0 knot before cutting the power. And for restarting when [GPS] is selected and the power it cut, make sure that the power of GPS has been ON before turning the power of this system to ON.

Display when the ship's speed input system is set

When setting the ship's speed input system, indications of the display are as follows.

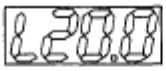
[LOG] :

[GPS] : 

[MANUAL] : 

*4 Indications after setting the ship's speed input system

Indications of the display after setting the ship's speed input system are as follows.

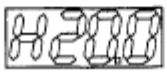
[LOG] : 

(Ships speed calculated from the log signal is displayed.)

[GPS] :

(Ship's speed obtained by GPS is displayed.)

*5 Indication after setting [MANUAL] of the ship's speed input system

[MANUAL] : 

The display blinks under this condition. Set the ship's speed with the data change switch(4) , and press the ENT switch (5) again to fix the value.

NOTE

Be sure to press the ENT switch (5) after finishing setting. The changed setting is not accepted if the ENT switch is not pressed after finishing setting.

(7) Setting the turn rate filter constant

Press the display switch © to set the display item LED © at [TURN], When the filter constant of the displayed value is to be changed, press the SET switch ® and the data change switch @ to set the filter constant at the desired value. Then, press the ENT switch © to fix the value.

The filter constant can be set from 2.0 to 10.0 sec at 2 sec interval.

This setting is for the display (D and analog output signal, and cannot be set for digital output.

NOTE

Be sure to press the ENT switch © after finishing setting. The changed setting is not accepted if the ENT switch is not pressed after finishing setting.

(8) Confirmation of master bearing (COMPASS bearing)

Make sure of lighting [RUNNING] of the mode LED © and press the DISP switch © to set the display LED © at the [COMPASS]. Make sure that the reading of the master compass card coincides with the bearing indicated in the display.

When the card reading is different from the data on the display, press the DISP switch (2) to set the display LED © at [COMPASS] and set the displayed value at the card reading after pressed the SET swtich ©. Then, press the ENT switch to fix the value.

CAUTION

When the master bearing is set by operations above, the repeater reading changes by the changed angle of master bearing. Be fully careful that course changing occurs during auto steering.

(9) Display of true bearing

Press the DISP switch (2)to set the display item LED (10) at the [TRUE]. Even when the display item LED is other than [TRUE] and no switch is operated for 30 sec, the display automatically becomes the [TRUE] bearing.

Monitoring in running

Perform monitoring in running as follows.

(1) Confirmation of start

Make sure that the [RUNNING] of the mode LED (11) on the operating panel is lighting. When the [RUNNING] does not come on even after 10 minutes have elapsed from the power turned ON, turn the POWER switch [OFF] once, and turn ON again after a while.

(2) Confirmation of alarm status

Make sure that the ALRM LED (8) on the operating panel is off. When abnormality occurs in the system, the alarm LED blinks and the buzzer sounds.

Confirm the error code indicated in the display and press the ALARM ACK switch (7) to stop the buzzer. When the alarm LED continues lighting even after pressing the ALARM ACK switch, the abnormality continues (when the abnormality is instant, the alarm LED goes off at the same time when pressing the ALARM ACK switch.). Take suitable actions according to "2-3.3 Alarm".

(3) Confirmation of master bearing

Make sure that the [COMPASS] display value coincides with the master compass card reading.

When a deviation generates between the [COMPASS] display value and the card reading, correct the deviation according to " 2-3.1 Start (8) Confirmation of master bearing".

The correction value of the [COMPASS] bearing is displayed as the offset value immediately after the POWER turned ON.

(4) Confirmation of latitude

When [GPS] in the latitude system is selected, the latitude obtained by GPS is displayed. Make sure that the value displayed in GPS coincides with the value displayed in the TG-6000. When [GYRO] in the latitude system is selected and the ship's speed signal is input from external equipment ([GPS] or [LOG] in the ship's speed system is selected), the displayed latitude value is automatically updated.

In this case, make sure of the displayed value in every period on the berth or at the interval of within 4 hours during navigation, and if there is a difference between the displayed value and the actual own ship latitude, reset the latitude value according to "2-3.1 Start (3) Setting the latitude input system".

CAUTION

A large changing of the latitude setting causes a large changing of the true bearing. Be fully careful that this causes a large course changing during auto steering.

When [MANUAL] in the ship's speed system is selected, the displayed latitude value is not automatically updated.

Input the actual own ship latitude in every period of berth or at the internal of within 4 hours during navigation.

(5) Confirmation of ship's speed

The gyro-compass generates error according to the ship's speed. The TG-6000 calculates error, and transmits and displays the corrected repeater signal.

Make sure that the displayed ship's speed value coincides with the actual own ship

speed, and if there is a difference between the displayed value and the actual own ship speed, reset the value according to" 2-3.1 Start (6) Setting the ship's speed input system".

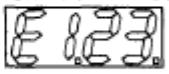
CAUTION

A large changing of the ship's speed setting causes a large changing of the true bearing. Be fully careful that this causes a large course changing during auto steering.

The error based on ship's speed and latitude can be known from the attached" Fig 2-3 Speed Error Graph".

Alarm

The TG-6000 alarms abnormality generated in the system with the buzzer sound and error code
display.

- When the alarm generates, press the ALARM ACK switch after confirming the error code.
- When the alarm is instant, the alarm LED goes off by pressing the ALARM ACK switch. When the alarm LED is lighting even after pressing the ALARM ACK switch, it shows the alarm condition continues.
- When the alarm condition continues, confirm the error code and take suitable actions according to the error code table shown below.
- When plural abnormalities occur at the same time, all of them are recorded. These are displayed on the display in order of generation from last like  and number of error codes abled to be displayed at one time is 3. When the decimal point of the unit digit is not lighting, it shows further alarms are generating. At this time, the error code not displayed can be confirmed by pressing the [+] key. Press the [–] key to return to the previous display.

Contents of alarm

CAUTION

When the alarm with the content shown below generates and to take any action, turn the POWER switch [OFF] and cut the main power and the emergency power at the main distribution box, etc., unless otherwise noted.

When frequent alarms occur, contact TOKIMEC service engineers.

Error code	Contents of alarm	Countermeasure
E-1	Main power is abnormal.	Make sure the power circuit fuse F1 has blown and check for the main power. (Fig. 5-1)
E-2	Power is abnormal.	Restart
E-3	Inverter is abnormal.	Restart
E-6	Rotor tilting angle is abnormal.	Restart.

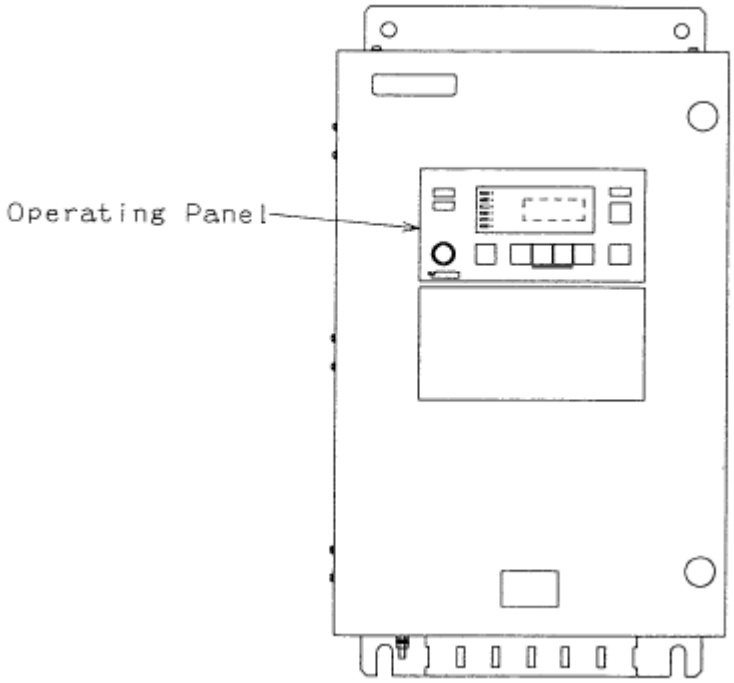
E-7	Servo loop is abnormal.	When this alarm generates , the rotor stops automatically. Start again.
E-8	Zero cross is abnormal.	
E-A	Communication is abnormal.	Confirm the COMPASS bearing in the display and the master compass card reading. When there is a difference between them, adjust according to "2-3.1 (8)".
E-c	GPS communication is disable.	Confirm connection wiring between master compass terminal board and external wiring terminal board. *1
E-d	GPS data is invalid.	Confirm GPS power or connection wiring between GPS and external wiring terminal board. *2
		Confirm GPS output format and output data.

*1 Communication is abnormal.
Between master compass terminal board and control unit external wiring terminal board Between
TXH - TXH, TXL - TXL
RXH-RXH, RXL-RXL
*2 GPS communication is disable.
Between GRXH and GRXL of external wiring terminal board and GPS.

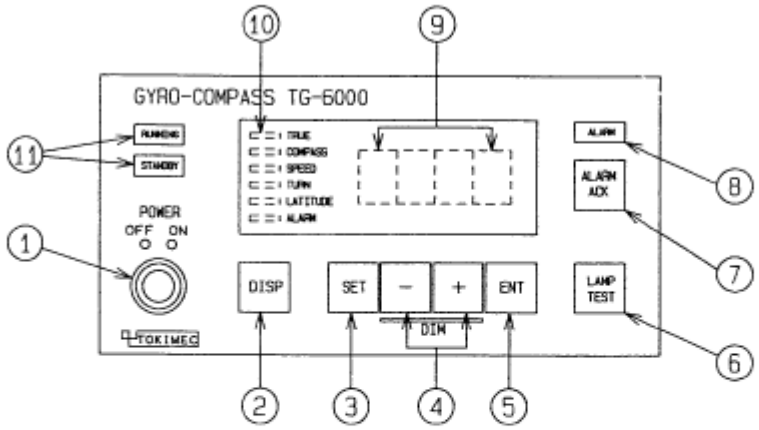
Actions to be taken when E-c, d generate.
When abnormality regarding GPS generates and to change the ship's speed / latitude system, confirm the ship's speed system first (change if necessary), and then confirm and change the latitude system.
After changing the ship's speed / latitude system, display the [TRUE] bearing with the DISP switch and confirm the blinking [TRUE] bearing. Then, press the

SET switch.
CAUTION
When the abnormality regarding GPS generates, this system corrects the speed error with the ship's speed / latitude data prior to the abnormality generation. After changing the ship's speed / latitude system when E-c, d generate, the true bearing may change. Confirm the true bearing. Be fully careful that this causes a large course changing during auto steering.

Stop
(1) Turn [OFF] each repeater switch.
(2) Turn [OFF] the POWER switch.

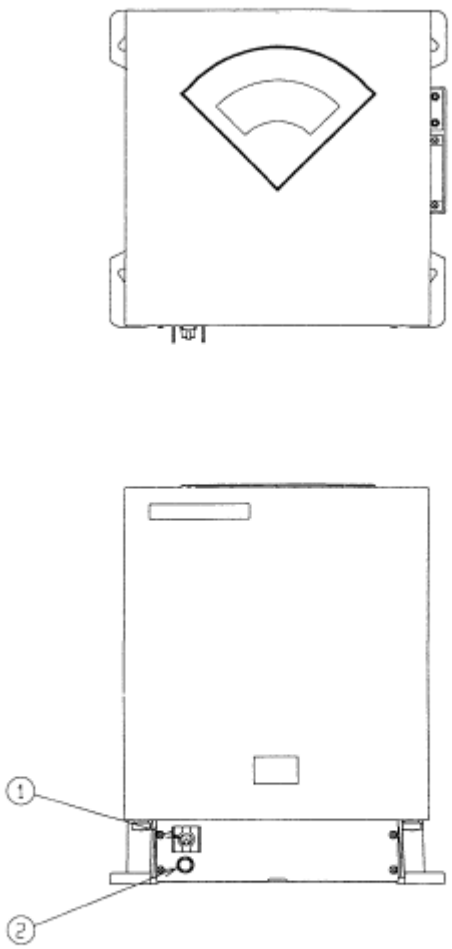


Control Box Operating Panel



① Power Switch
② Display Switch
③ Setting Switch
④ Data Cange & Input System Select Switch, Dimmer Switch
⑤ Enter Switch
⑥ Lamp Test Switch
⑦ Alarm Ack Switch
⑧ Alarm LED
⑨ Display
⑩ Display Item LED
⑪ Mode LED .

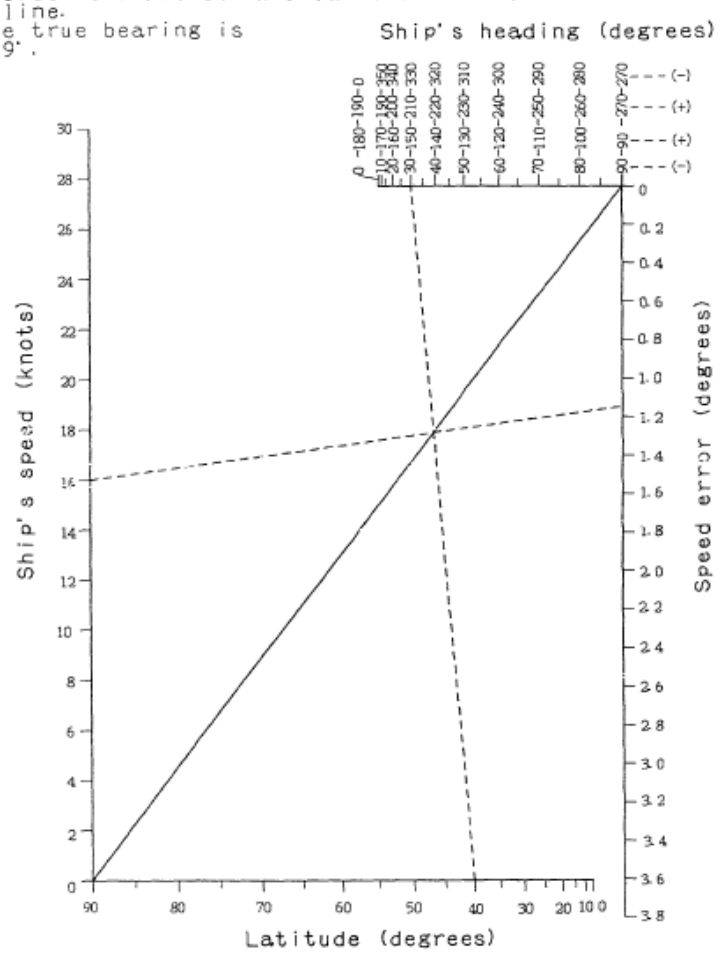
Fig. 2-1 Control Box and Operating Panel



① Dimmer switch
② Fuse holder

Fig. 2-2 Master Compass

*How to obtain speed error
Speed error (example 1.15°) can be obtained at the point where the speed error graduation line intersects with the line which is extended from the ship's speed (example 16 knots) across the intersection of the line between the course (example 30°) and latitude (example 40°) with the slanted solid line.
Accordingly, the true bearing is
30° - 1.15° = 28.9°.
(See Notes)



Note: 1. When the course is 270° ~0° ~90°, the true heading is the value of the compass heading from which the speed error is subtracted.
2. When the course is 90° ~180° ~27°, the true heading is the value of the compass heading to which the speed error is added.

Fig. 2-3 Speed Error Graph

4.4 Maintenance

The routine maintenance and check for the gyrocompass TG-6000 are very simple, however since correct handling is the only way to maintain good characteristics of the gyrocompass over a long term, it is required to pay full attention on maintenance works.

Routine Check

Check the following items at least once a day even in lay days.

(1) Check synchronization between the true bearing display of the operating panel and the repeater compass.

Synchronize them when there is a deviation.

(2) Make sure that the latitude display of the operating panel matches with latitude of

the current position.
If there is a deviation, reset the latitude.
(3) Check the error by measuring bearing if possible.
(4) Make sure the power supply voltage is constantly maintained.
(5) Normal running of the master compass generates no noise, vibration or overheating, etc.
It is very effective to know normal running conditions well and to compare them with current running conditions for early detection of abnormalities.

Periodical Check
The gyrocompass has a high speed rotor and many other moving parts.
These moving parts are lubricated with high-grade lubricating oil, which is unavoidable deteriorated with time elapsed. Packings and other parts may also be degraded.
Therefore, the gyrocompass needs disassembly and cleaning at a periodical check and maintenance by TOKIMEC service engineer. Please contact your nearest service station when the time for periodical check comes.
The disassembly and cleaning requires special technology, equipment and tools. Never disassemble the gyrocompass by yourself, as it may cause further trouble.

Other Check
The TG-6000 gyrocompass does not need any check or maintenance other than above. However, check for looseness of wiring terminal screws, oil adhering or component wear from time to time, and make maintenance when necessary.
WARNING
Turn the POWER switch [OFF] and cut the main power and emergency power at the main distribution board, etc., before taking any action for check.

TROUBLESHOOTING
WARNING
Turn OFF the POWER switch and cut the main power supply and the emergency power supply at the main distribution board, etc., before performing cause investigation and repairing works when any failure has occurred.
- In this clause, possible countermeasures on board are described.
- Never use fuses other than specified capacities for replacement.

1. The gyro does not operate even by turning the POWER switch in the operating panel to "ON".
(1) Make sure supply conditions of main power and emergency power.
* Main power supply 100/220 VAC ±10%, 50/60 Hz
* Emergency power supply 24 V DC +30%-20%
<CAUTION> Be fully careful of electric shock when checking.
(2) When there is no problem in clause (1), confirm fuses after cutting the main / emergency power supply at the main distribution board, etc.
Fuses are provided at the left side and at the upper right part closed to the center of the

power supply unit.
Make sure if fuses have blown.
F1--------6.3 A
F2--------20 A (Fig. 5-1)

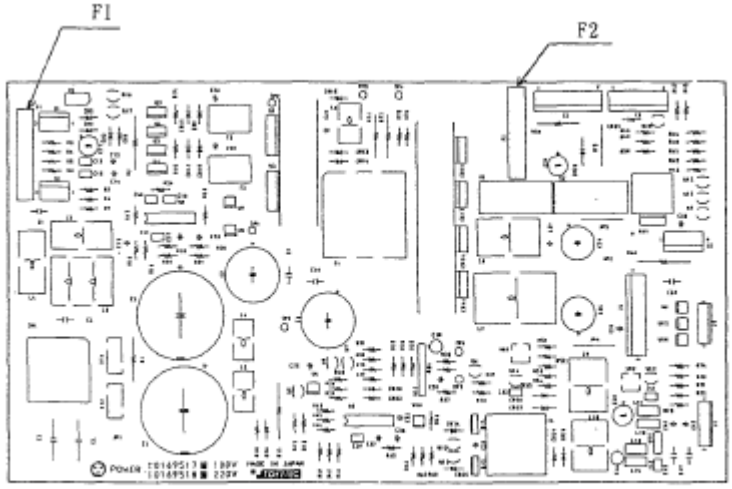


Fig. 5-1

2. Repeater does not operate.
NOTE
In this system, repeaters do not operate during running with the emergency power. The system, however, having the repeater back up signal by the special specification can operates repeaters up to 3 circuits even during running with the emergency power.
(1) A fuse is provided in each repeater circuit in the external wiring terminal board. Check if fuse (F1 ~ F9) have blown.
*F1 ~F9 1A (Fig. 5-2)
(2) When additional repeater circuits are installed based on the special specification, check each fuse (F10 ~ F22) on the ADD PWB of the external wiring terminal board.

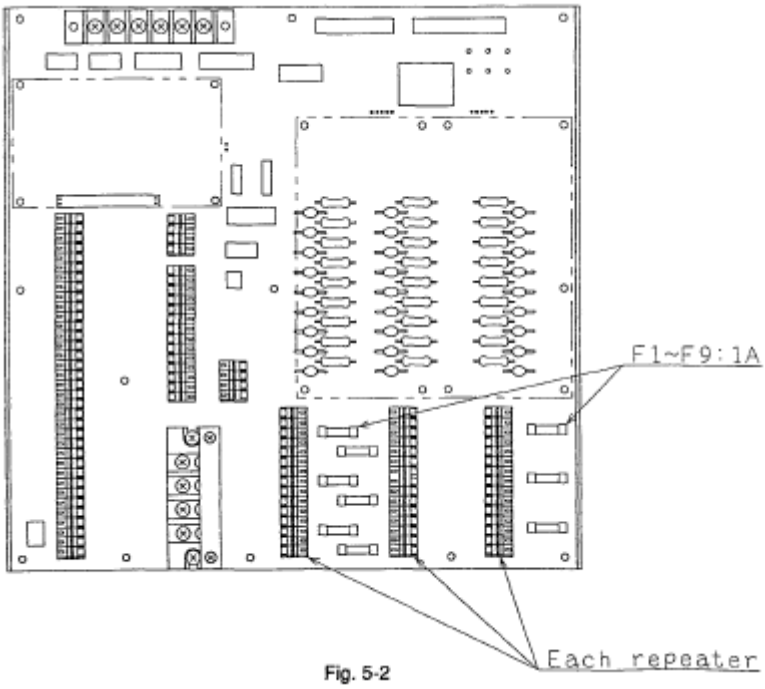


Fig. 5-2

3. Alarm generates at the same time when the power turned ON.

(1) When the error code E-3 and E-A generate at the same time, turn [OFF] the power once and turn [ON] again after approx. 1 minute.

(2) When the status does not change by the action of above (1), check the fuse for the inverter located at the lower part of the master compass (under the card illumination switch).

* F1 ---------15A (Fig. 2-2)

4. Others

When failures or alarms other than above generate, and when replaced fuses blow again, turn [OFF] the POWER switch in the operating panel and cut the main power supply and the emergency power supply at the main distribution board, etc. Then contact TOKIMEC service engineers immediately.

In this case, faster service action is available when the alarm code is informed.

II Magnetic compass

1 NAVPOL I

1.1 System overview

1.1.1 General

The Aluminum NAVIPOL binnacle is designed to accept the JUPITER type magnetic reflector compass with a 180 mm diameter compass card. A hood fitted to the binnacle will protect the compass from the elements.
The NAVIPOL III binnacle has a glass window in the hood to view the compass. The NAVIPOL I binnacle has a reflector tube fitted to allow the compass reading to be viewed from below decks.
The reflector tube is an optional fitting for the NAVIPOL IM and IS binnacles. The binnacle contains all the compass correction facilities that are required by the authorities.

1.1.2 The Binnacle and Hood

The binnacle is manufactured of Aluminum. The Aluminum has been anodized and electrostatic coated as protection against seawater cor¬rosion. The hood is manufactured in plastic and attached to the binnacle with two knurled screws.

1.1.3 Compass Illumination

There are two systems of compass illumination - normal and emergency. The brightness of the normal illumination can be varied by using the dimmer switch. All electrical connections are made in a watertight terminal box located at the base of the binnac

1.1.4 Compass Corrections - NAVIPOL I, II, III, IM only

The compass corrections are located inside or on the binnacle. The B-C corrections are made by rod magnets which can be inserted into 13 bores, inside the binnacle, from the port, starboard and aft sides. The heeling error corrector is suspended by chain inside the bucket tube located on the center axis of the binnacle.
D correction is realized by two soft iron spherical quadrantal correc-ors located on

two arms at the port and starboard sides of the binna-le. The quadrantal correctors can be moved towards and away from the compass. The soft iron (Flinders) bar case is attached to the fore side of the binnacle. The case will accept the various lengths of Flinders bars and PVC tube sections.

1.1.5 Compass Corrections - NAVIPOL IS and T only

The B and C corrections for the NAVIPOL IS and T is achieved by two pairs of magnets. One pair is for B correction, the other pair for C correction. The magnetic field strength can be adjusted infinitely over a 20° deviation. The direction of the magnetic fields can be reversed.
The heeling error correction is realized by corrector magnets that may be fixed at infinitely variable heights. The heeling error tube is located vertically below the B and C corrections.

1.1.6 D Compass Correction - NAVIPOL T only

There are no D spherical quadrantal correctors fitted to the NAVIPOL T binnacle. D correction is done on the compass itself and is an optional fitting.
Compass Reflector
A 15° section, on both sides of the lubber line, of the compass card can be viewed through the reflector tube from below decks. The maximum length of the reflector tube is two meters. The viewing mirror angle can be varied and is double sided. The reverse side of the viewing mirror is a darkened mirror for night observation of the compass reading. A second fixed viewing mirror is positioned opposite the variable viewing mirror to allow a second person to observe the compass reading. The reflector tube is fitted to the NAVIPOL I binnacle and is an optional fitting on the NAVIPOL IM and IS binnacles.
Clinometer (optional)
A clinometer can be attached to the aft side of the binnacle. This is an optional fitting.

1.2 Technical data

Overall height	1320 mm	NAVIPOL I, II, III
	1050 mm	NAVIPOL IM
	550 mm	NAVIPOL IS
	430 mm	NAVIPOL T
Compass card height	1140 mm	NAVIPOL I, II, III
	870 mm	NAVIPOL IM
	370 mm	NAVIPOL IS
	260 mm	NAVIPOL T

Base diameter	520 mm	NAVIPOL I, II, III, IM, IS
	310 mm	NAVIPOL T
Support arm width	1075 mm	NAVIPOL I, II, III, IM, IS
Overall width with Flinders bar case	570 mm	
Reflector tube dimensions		
Viewing length	2000 mm	max.
Tube diameter	140 mm	
Mirror housing diameter	170 mm	
Lens diameter	150 mm	
Focal length f	670 mm	± 10 mm
Compass illumination	- NAVIPOL I, II, III, IM, IS only	
Normal	Ba15d, 25 W lamp	voltage dependant on ship's power supply (24V, 110V or 220V)
Emergency	Ba15d, 25 W lamp	voltage dependant on ship's emergency power supply
Compass illumination	- NAVIPOL T only	
Normal	Ba15d, 25 W lamp	24V only
Emergency	Ba15d, 25 W lamp	24V only

1.3 Operation

1. The hood can be removed by loosening the two knurled retaining screws.
2. By loosening the screw on the port side of the mirror housing, the viewing angle of the mirror can be adjusted by turning the knob on the starboard side of the mirror housing.
3. The access door, on the aft side of the binnacle, can be removed after loosening the retaining screws. This will permit access to the compass illumination, the reflector lens and the compass corrections.

1.4 Maintenance

The NAVIPOL binnacle does not require regular maintenance. It is recommended that the viewing mirror, reflector lens, top verge glass and the hood window are cleaned at regular intervals with a damp chamois leather.

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III Echosounder

1 DEBEG 4630

1.1 System overview

If it is desired to display echogram for a longer period of time, lower feed rates (plot speeds) can be chosen without affecting the rate of sounding specified for the current depth range, thereby allowing the current information updating rate to be maintained regardless of feed speed in use.
Possible interference from other echo sounders operating in the vicinity can be effectively eliminated or reduced with a 3–step noise reduction function.
The acquired data will also be output via RS–232C and RS–422 connectors simultaneously for use in applications requiring depth, date/time and position information. If water temperature data is needed, a thermistor sensor is optionally available and can be plugged into a devoted connector. To obtain a hardcopy of the present screen, a Centronics parallel port is also provided, which supports commercially available DOS/V–compatible monochrome graphics printers with ESC/P control protocol.
The built–in alarms include depth alarm, missing–bottom alarm, power failure alarm and power removal/shutoff alarm.
The depth alarm alerts the operator to decreasing depth (shallow alarm). A variable depth marker can be turned on to set the alarm depth graphically as well as digitally.
The missing–bottom alarm warns against the bottom echo being lost, becoming too weak or exceeding the current range limit.
The power failure alarm will be activated if the power line voltage drops below the factory–specified predetermined level.
The alarm activation status will be indicated both audibly and visually, and the alarm outputs will be separately available for driving externally connected alarm devices through a devoted connector.
The power removal/shutoff alarm, independently controlled by a devoted circuit based on a high–speed large capacity condenser, will be triggered in the event power is removed or shut off, emitting a repeating beep for several minutes continuously. A devoted reset switch is provided on the rear panel (early serial number versions) or behind the hinged front lid (later serial number versions) to silence the warning sound.
Both AC and DC power supplies are built in as standard, making it possible to connect the equipment to both AC and DC power sources at the same time. Should AC power outage occur in this configuration, the DEBEG 4630 will automatically switch to the DC power source.

1.2 Technical data

- Display Screen: 10.4 inch 7–analog RGB-color backlit TFT–LCD, VGA (640-480 pixels), with backlighting level adjustable in 10 steps
- Data Storage:

Numeric Data: Up to 24* hours of sounding data, depth range, frequency, associated UTC date/time, LAT/LON** and water temperature** readouts are automatically retained in flash memory protected from power shutoff or system reset.

*Compliant with paragraph 5.1.8 of IMO res. MSC.74(69).

** Optional GPS and temperature sensors required.

Graphics Data: Graphics image (full color echogram) of approx. past 10 minutes in temporary storage.

- Data Retrieval: Stored sounding data (NMEA–0183 DPT format) of past 15 minutes, 1/3/6/12*/24 hours can be retrieved from flash memory and can be graphically displayed in a devoted data history window, together with associated UTC date/time, and LAT/LON coordinates**. All stored data can be output in NMEA proprietary format on demand via RS–232C, RS–422 and I/O DATA connectors simultaneously.

*Compliant with paragraph 5.1.8 of IMO resolution MSC.74 (69)

**Optional GPS sensor and temperature sensors required.

- Keypad Backlighting: Adjustable in 7 steps by front panel dimmer key
- Cabinet Dimensions: 366 (W).275(H).110(D) mm, less mounting bracket 5.2kg (cabinet) + 1.4kg (mounting bracket)
- Power Requirements: 110 – 220 VAC (10%), single phase or 11 – 40 VDC.

Power consumption: approx. 25W (DC) or 30VA (AC)

- Ambient Temperature: –15 to +55.C, 95% RH (operating, without condensation) –40.C (storage)
- Compass Safe Distance: 1.8 meters for cabinet, 2.4 meters for mounting bracket

②Echo Sounder Specifications

- Depth Ranges (Maximum Range Limits, in meters):

	A	B	C	D	E	F	G	H
• •Meters (m, default):	5	10	20*	40	100	200*	400	1000
• •Fathoms (FM):	2.5	5	10	20	50	100	200	500
• •Feet (FT):	20••	40	100	200	400	1000	2000	4000

* These ranges comply with paragraph 5.1.1 of IMO resolution MSC.74(69).

- Transducer Draft: Adjustable in 0.1–meter steps for each transducer.
- Keel Offset: Adjustable in 0.1–meter steps for each transducer.
- Transducer Frequencies*:

Standard: 100 kHz

Option: 50 kHz (14.X20.) and 200 kHz** (7.), both elements placed in single ABS housing

*The transducer frequency (channel) in use is indicated at the screen's upper edge, complying with paragraph 5.1.7.2. Of IMO resolution MSC.74 (69).

** 200 kHz operation is not type–approved by BSH for navigational purposes.

■ Transmit Power: Approx. 1000W RMS (8 kW peak/peak) to transducer, adjustable in 4 steps automatically or manually.

.. Auto: Appropriate power level for range in use

.. Manual: 1/ 1 (full power), 1/ 4, 1/ 25, and 1/ 100

■ Transmit Pulse Lengths (in milliseconds):

	A	B	C	D	E	F	G	H
• •Meters (m) :	0.1	0.1	0.2	0.6	1.2	1.2	2.2	2.2
• •Fathoms (FM):	0.1	0.1	0.2	0.6	1.2	2.2	2.2	2.2
• •Feet (FT):	0.1••	0.2	0.3	0.6	1.2	1.2	2.2	2.2

■ Sounding Rates (per minute):

	A	B	C	D	E	F	G	H
• •Meters (m)* :	120	120	120	120	60	30	30	30
• •Fathoms (FM):	120	120	120	120	120	60	30	30
• •Feet (FT):	120••	120	120	120	60	30	30	30

*The sounding rates on metric depth ranges comply with paragraph 5.15 of IMO resolution MSC.74 (69).

■ Velocity Standard: 1500.0 meters/second, fixed

■ Minimum Detectable Depth:

.. 50 & 100 kHz: 1 meter*

.. 200. Hz**: 50 centimeters

* Compliant with paragraph 5.1.1 of IMO resolution MSC.74 (69).

** Results obtained from 200 kHz operation must not be used for navigational purposes.

■ Accuracy of Measurement:

.. 20 meter range: Better than.0.5* meters

.. 200 meter range: Better than.5* meters

.. Other ranges: Better than.2.5* % of digital depth readout.

* Compliant with paragraph 5.2.1 of IMO resolution MSC.74 (69).

■ Range Discrimination:

.. 20 meter range: Approx. 6.5* mm per meter (20m range across 130 mm)

.. 200 meter range: Approx. 0.65* mm per meter (200m range across 130 mm)

* Compliant with paragraph 5.2.2 of IMO resolution MSC.74 (69).

■ Echogram Presentation: Echoes are displayed in up to 7 analog RGB colors, depending on strength, with red representing the strongest echo level and blue, the weakest level (default settings). Color–strength assignments can be user–defined.

■ Display Duration: The displayed echogram remains on screen for approx. 20–21* minutes, depending on depth range in use.

*Compliant with paragraph 5.1.3 of IMO resolution MSC.74 (69).

■ Echo Dynamic Range: Change in echo indication to next stronger/weaker color normally represents a 5 dB change in strength. Other dynamic range is selectable from 3, 4, or 6 dB.

■ Display Modes: The following display modes are selectable:

.. Single frequency (channel) full screen display

.. Single frequency split screen display with left half screen showing bottom echogram recalled from memory.

.. Dual frequency (channel) split screen display
(CAUTION: This mode of display must not be used for navigational purposes)

■ Echogram Feed Rates (Plot Speed):

1/ 1, 1/ 2, 1/ 4, 1/ 8, 1/ 16 and freeze. The sounding rate for the depth range in use remains unchanged regardless of the feed rate selected.

■ Noise Reduction: 3 steps (low, mid and high)

■ Receiver Gain: Continuously adjustable for each operating frequency

■ TVG (STC): Continuously adjustable for each operating frequency

■ Audible and Visual Alarms:

The following alarms are built in and enabled at all times with the equipment switched on, and comply fully with the specifications described in paragraphs 5.3.1 and 5.3.2. of MSC.74(69), Annex 4:

.. Depth: Warns against decreasing depth, with alarm triggering depth user–presettable in 0.1–meter steps.

.. Audible: Beeps at approximately 1–second intervals. The sound can be muted by pressing

.

.. Visual: Blinks alarm symbol▲ and on–screen preset value on red background at approximately 1–second intervals.

.. Missing Bottom: Warns if bottom echo is lost or too weak to measure depth, or if depth exceeds the range limit, for 4 seconds or more.

.. Audible: Beeps at approximately 1–second intervals. The sound can be muted by pressing

.

.. Visual: Blinks on–screen depth readout unit (m, FM, BR, or FT) at approximately 1–second intervals.

■ Audible and Visual Alarms (continued – 2/2)

.. Power Failure: Warns against drop of power supply voltage below factory–specified level (11V) for DC powered operation.

.. Audible: Beeps at approximately 1–second intervals. The sound can be muted by pressing

.

.. Visual: Blinks alarm symbol and on–screen voltage readout on red background at approximately 1–second intervals.

.... Power Removal/Shutoff: Warns against removal or shutoff of power source for both AC and DC–powered operation. (Audible indication only, in the form of a beep occurring at approx. 1–second intervals for at least 5 minutes). The sound can besilenced by pressing rear panel “POWER ALARM” button (early s/n versions) or the alarm reset switch behind hinged front lid (later s/n versions).

■ External I/O Interface Specifications

.. Data Outputs: NMEA–0183 sentences ($SDDPT*, $SDMTW) via
RS–232C and RS–422 ports and 8–pin I/O DATA connector

* Depth data will be output in meters only regardless of the depth readout unit in use.

.. Stored Data Output: NMEA–0183–compatible proprietary format ($PJMCN**) via RS–232C and RS–422 ports and 8–pin I/O DATA connector

** Depth data will be output in meters only regardless of the depth readout unit in use.

.. Data Inputs: NMEA–0183 sentences ($GPGGA, $GPRMC, $GPVTG, $GPZDA) via RS–232C or RS–422 ports or I/O DATA connector

.. Alarm Output: Open–collector, 50V/ 800mA max., via ALARM connector

.. Printer Output: Centronics parallel, via "PRINTER" port for monochrome DOS/V printers with ESC/P control protocol

- Temperature Sensor: T–200 thermistor(option, 5 k.. at 25..C) via rear panel connector "TEMP." With the sensor connected, water tem– perature data will be appended to NMEA–0183 output strings. The 570–50/ 200 transducer has a T–200 sensor embedded.

NOTE: Specifications other than those stipulated in IMO resolution MSC.74(69) Annex

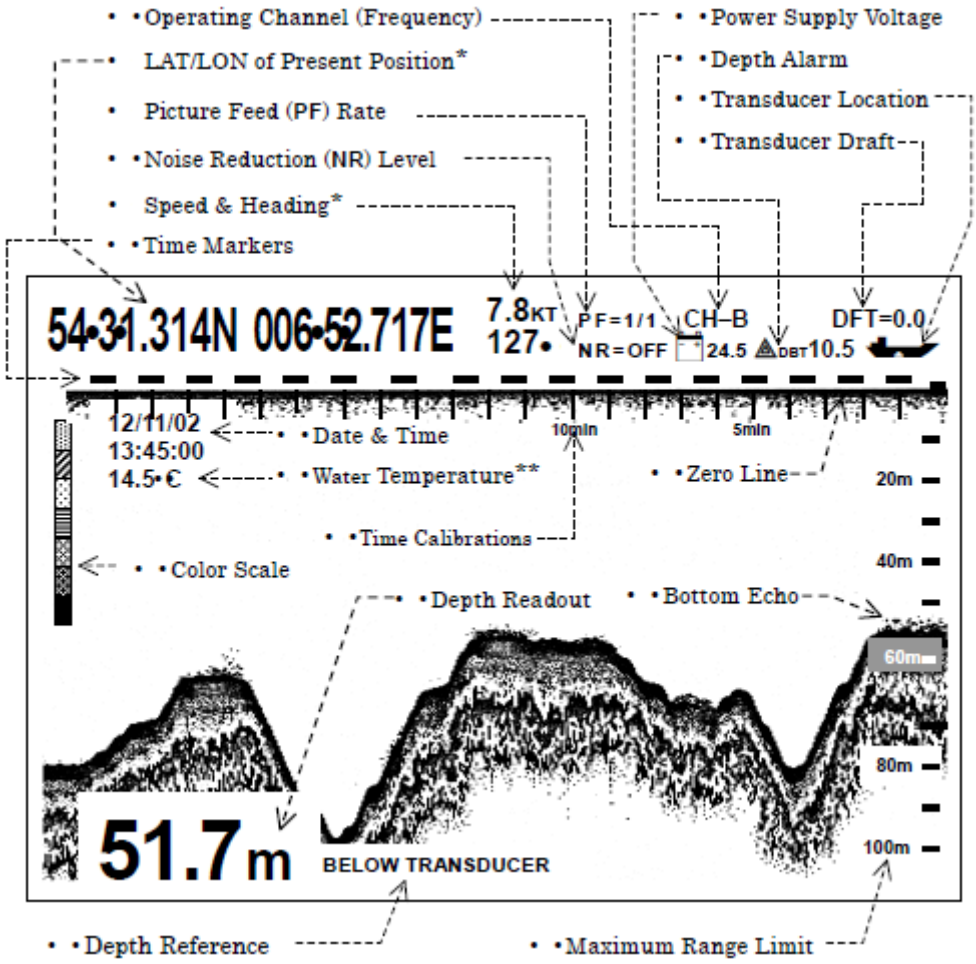
4 or in EN ISO 9875 are subject to change without notice or obligation.

1.3 Operation

1.3.1. Interpreting Navigation Sounder Screen

The figure below illustrates a typical operating display showing the bottom topography using a low frequency transducer. A brief description of on–screen readouts and objects is given below.

Figure 3-1 Typical Full Screen Echogram Display



* Optional GPS sensor required. ** Optional temperature sensor required.

■ Bottom Echo

The bottom echo stratum is shown in up to a total of seven different colors, depending on the strength. The colors that are used to display the bottom are shown on the color scale in order of strength. Red, which is initially at the lower end of the scale, represents the strongest part of the echo (e.g. hardest layer of bottom stratum), and blue, initially at the upper end of the scale, represents the weakest part (e.g. softest layer of the bottom).

■ Depth Readout

The depth to the bottom from the transducer is indicated here.
Readout Unit: m=meters (default), FM=fathoms, BR=braccia, FT=feet
Refer to paragraph 4.9.3 for details.
* To comply with IMO resolution MSC. 74(69), depth measurements must be made in meters.
To obtain a continuous, stable indication, the bottom echo must be displayed in red, orange or yellow (or three user–defined strongest echo colors). The appropriate gain control should be adjusted accordingly. The TVG control may also have to be adjusted to prevent surface clutters from disturbing digital depth reading operation.

If the bottom echo is lost or too weak to measure depth for 4 seconds or more, or if the current depth exceeds the limit of the range in use for 4 seconds or more, the missing bottom alarm will be triggered, blinking the current readout unit on a red background with digital readout turned off, and emitting a beep at approx. 1–second intervals. Increase the receiver gain or select a greater range to rectify this situation. See paragraph 3.12.3 for more details about the alarm function.

■ Depth Reference

The reference to which measured depth is to be referred is indicated here.
BELOW TRANSDUCER: Depth referred to transducer (initial setting), DBT
BELOW SURFACE: Depth referred to surface (waterline), DBS
BELOW KEEL: Depth referred to ship's keel, DBK
See paragraph 4.3 for details.

■ Zero Line

This red, thick line is caused by a portion of transmitting energy leaking into the receiver, and its upper edge represents the on–screen position of the transducer face. When the transducer draft (, depth from waterline to transducer) is entered, the zero line shifts toward the bottom by the amount of the draft. See paragraph 4.2 for greater details on draft entry. When the depth reference is set to "BELOW KEEL" with the correct keel offset (distance from transducer to keel) entered, the zero line shifts above scale line 0 by the amount corresponding to the offset, and its display is suppressed intentionally. See paragraph4.9.8.3 for details. Numerous small echoes just below the zero line are reflections from plankton concentrations, air bubbles and other tiny objects near the waterline. The presence of the zero line in the strongest color*, except in the case of depth–below–keel (DBK) reference setting, indicates that both the transmitter and the receiver are working consistently. * See paragraphs 3.4.1 and 4.9.2.

■ Maximum Range Limit

The lower limit of the selected depth range is indicated here. The range can be changed by pressing

(greater ranges) or

(smaller ranges). When the automatic bottom tracking function is activated (by pressing

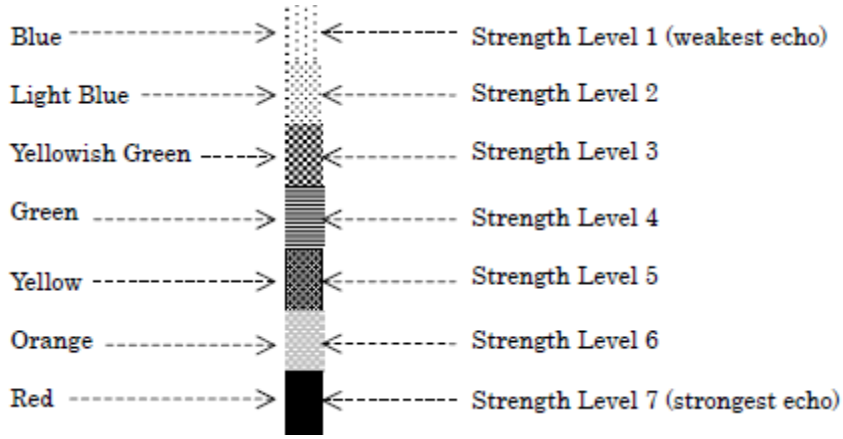
), the maximum range limit will change automatically so that the bottom echo is always displayed in the screen's lower half area. See paragraph 3.3.2 for details.

■ Color Scale

The colors used to display various echo strength levels are listed here in order of relative strength. The color that represents the strongest level is initially red, and the one that represents the weakest level is initially blue. The intervening colors simulate various mid strength levels. See paragraph 4.9.2 for related information. An echo must be initially 5 decibels (dB) stronger or weaker than the adjacent strength level

before it can be displayed in next stronger or weaker color. See para–graph 4.9.4 for greater details.

Figure 3-2 Initial Assignments of Echo Colors



■ Date and Time

Date is shown in MM/DD/YY (month/ day/ year) format. Time is in 24–hour HH:MM:SS (hours: minutes: seconds) format, and UTC unless a local time offset is entered. See paragraphs 4.9.5 and 4.9.6 for date/time preset instructions. With a GPS sensor plugged in, the time is synchronized with the GPS time.

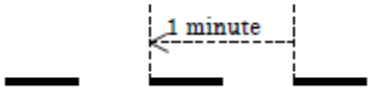
■ Water Temperature Indication

The water temperature is indicated here when an optional temperature sensor is plugged into the rear panel connector “TEMP.” See paragraph 4.9.7 for details.

■ Time Markers

Each marker shows up at one–minute intervals on any depth range, as in the example below. By counting the number of markers across a particular horizontal section, you can check how many minutes have elapsed while traveling across that section.

Figure 3-3 Time Marker Interval – Example



■ Time Calibrations

The screen is horizontally calibrated in time related to the echogram feed rate (PF rate) in use, as follows:

1–minute intervals at PF=1/1
2–minute intervals at PF=1/2
10–minute intervals at PF=1/4
20–minute intervals at PF=1/8
40–minute intervals at PF=1/16

From the on–screen calibrations, you can estimate at a glance the time duration between two specific points on the current echogram.

< CAUTION >

The time interval between adjacent calibrations will change as you select feed rates.

Therefore, if you switch to a different feed rate, the new calibrations will no longer apply to the current echogram.

■ Operating Channel (Transducer Frequency)

The operating channel (i.e. frequency of the transducer in use) for current depth measurement is indicated here. The channel can be switched by pressing

.

See paragraph 3.7 for more details.

CH–A: Channel A

CH–B: Channel B

< CAUTION >

To comply with the type–approval regulations, the equipment must be operated on the channel to which either the 50 kHz or 100 kHz transducer is assigned.

■ Noise Reduction (NR) Level

Echo sounders operating nearby or other onboard electronics can become a source of interference. Noise reduction (NR) is the action of preventing such interfering signals from cluttering the operating screen. The following NR levels can be selected by repeatedly pressing

:

NR=LOW: Sets NR function at low reduction level.

NR=MID: Sets NR function at medium reduction level.

NR=HIGH: Sets NR function at high reduction level.

NR=OFF: Disables NR function. (initial setting)

■ Picture Feed (PF) Rate

Echo picture (echogram) feeds automatically to the left at a rate with passage of time. The feed rate affects the duration of echo display across the screen, and can be changed in the following steps by pressing

:

PF=1/1: Feeds once every sounding. (fastest feed rate – initial setting)

PF=1/2: Feeds once every two soundings.

PF=1/4: Feeds once every four soundings.

PF=1/8: Feeds once every eight soundings.

PF=1/16: Feeds once every 16 soundings. (slowest feed rate)

PF=STOP: Freezes picture feed.

The rate of sounding for the range in use is not affected by feed rate selection. The on–screen time calibration intervals change with the feed rate in use. See □ for details.

■ Power Supply Voltage

The power supply voltage is indicated here while the equipment is operating from a DC power source (11 to 40V). When the equipment is powered by an AC power source, the indication changes to “AC” without a voltage value. In a system where

both DC and AC power sources are connected to the equipment at the same time, the AC power is automatically selected for echo sounder operation. In the event of AC power outage, the equipment will automatically switch to the DC power supply.
If, for any reason, the voltage drops below 11V during DC–powered operation, a power failure alarm will be activated, audibly and visually warning you of the trouble. See paragraph 3.12.4 for greater details.

Figure 3-4 Visual On–Screen Indication of Power Failure Alarm – Example

In the event that power is removed or shut off while the equipment is working from either AC or DC power source, an audible alarm will sound for several minutes. To silence this alarm, press either the button* marked POWER ALARM placed behind the hinged front lid or the rear panel button marked "POWER ALARM ." See paragraph 3.12.5 for more details.
* This button, accessible by opening the hinged front lid, is installed in later serial number models.

■ LAT/LON of Present Position

When an optional GPS sensor is plugged into the rear panel " I/O DATA" connector or when a position data signal from other GPS receiver is fed to that connector, the equipment will display the latitude/longitude coordinates of your present position here and stores LAT/LON data in memory along with digital depth reading.

■ Speed and Heading

When an optional GPS sensor is plugged into the rear panel "I/O DATA" connector or when an appropriate data signal from other GPS receiver is fed to that connector, the equipment will display GPS–derived speed–over–the–ground (SOG) and heading (course–over–the–ground or COG) here.

■ Depth Alarm

The alarm depth is indicated here. The abbreviation to the right of the symbol indicates the reference used in setting the alarm depth. See paragraph 4.3 for more information on the reference.
DBT: depth below transducer (initial setting)
DBS: depth below surface
DBK: depth below keel
As soon as the current depth decreases beyond that value, the depth alarm will be triggered. The alarm depth can be set via the following steps. See paragraph 3.12.2 for greater details.

(1) Turn on the Variable Range Marker (VRM) by pressing 5 SET ALARM .

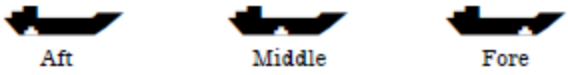
(2) Repeatedly press / to place VRM at the desired alarm depth.

(3) Press ENT MARK .

■ Transducer Location

The relative location of the transducer currently in use is graphically indicated here. See paragraph 4.9.8.2 for greater details.

Figure 3-5 Relative Location of Transducer in Use



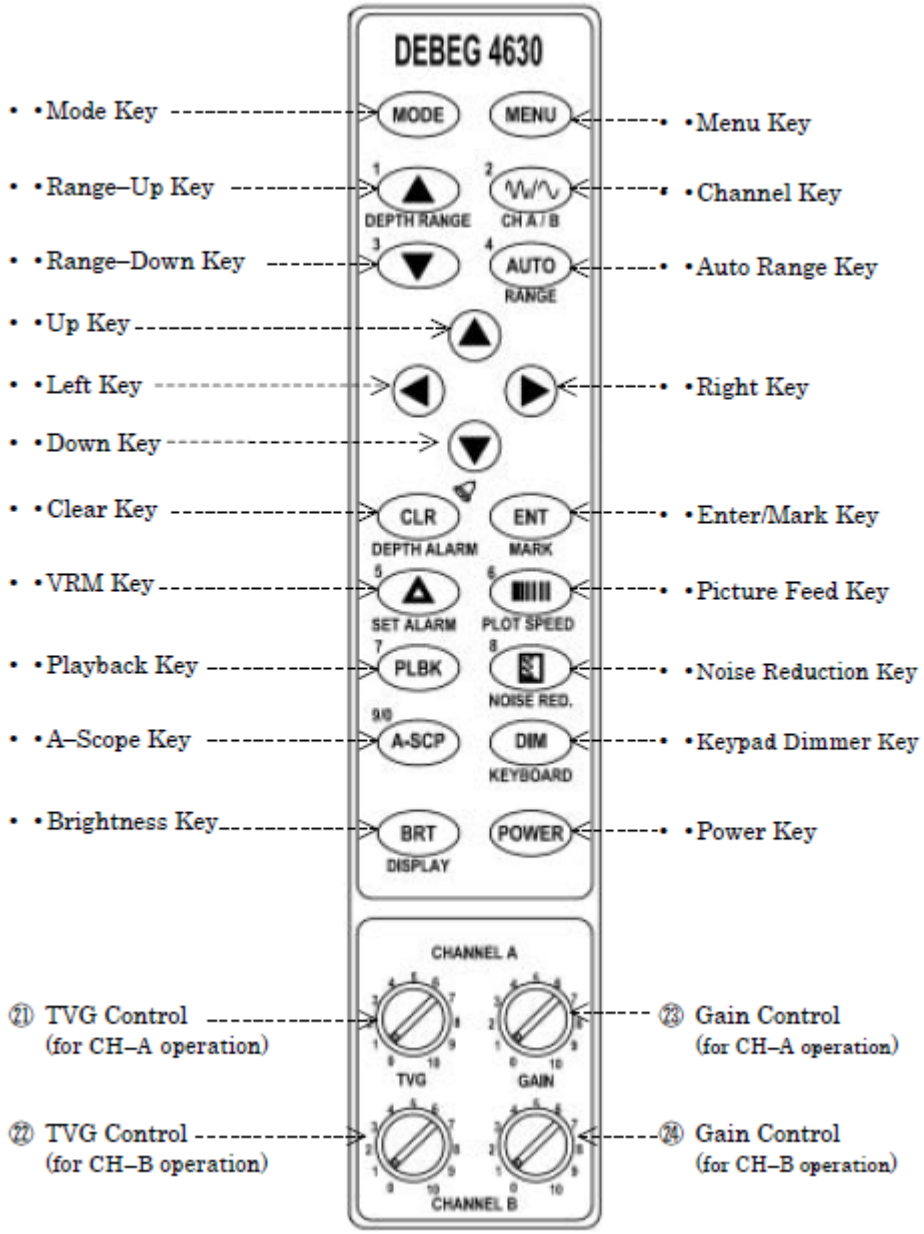
■ Transducer Draft (or Keel Offset)

When the depth reference is set to “BELOW SURFACE” with the appropriate transducer draft entered, its value (depth from waterline to transducer) is displayed here in the form of “DFT=X.X.” See paragraphs 4.2 and 4.3 for more information. When the depth reference is set to “BELOW KEEL” with the appropriate keel offset entered, the keel offset value is indicated here in the form of “KL=X.X.” See paragraphs 4.3 and 4.9.8.3 for more information.

1.3.2. Control Panel Functions

The figure below shows the control panel of the equipment. A summary description of the functions the keys and controls provide is given on the following pages.

Figure 3-6 Control Panel



■ Mode Key

On normal echogram screen with no menu opened This key selects the following two display modes:

Full screen mode

The entire screen area is used to display echoes received from operation on either channel A or channel B.

Split screen mode

The screen is split into right and left halve pages, with the right half showing current sounding while the left half showing echogram being recalled from memory.

NOTES:

(1) Before echogram can be recalled from memory, you must store the current right half into memory by pressing ENT MARK. See paragraph 3.5 for more information.

(2) When the screen is split to show channel A and channel B echograms across the right and left halve pages, pressing this key returns the full screen page.

On Menus
When a number of menus are being displayed, pressing this key closes all of them at a time, returning you to the normal echogram screen. (i.e. performs the same function as CLR DEPTH ALARM)

NOTE: Turning the equipment on while holding down this key for a few seconds opens a SYSTEM MENU. See section 5 for details.

■ Range–Up Key 1 DEPTH RANGE

On normal echogram screen with no menu opened
Selection of Depth Ranges
Pressing the key during normal sounder operation selects smaller depth ranges. For example, if the current depth range is 100 meters (0 to 100m), pressing the key once selects the 40 meter range (0 to 40m).
On Menus
Entry of Numeric Data
When a menu is being opened for numeric data entry, pressing the key enters numeric value 1.

Range–Down Key 3

On normal echogram screen with no menu opened
Selection of Depth Ranges
Pressing the key during normal sounder operation selects greater depth ranges. For example, if the current depth range is 100 meters (0 to 100m), pressing the key once selects the 200 meter range (0 to 200m).

■ Range–Down Key 3 (continued – 2/2)

On Menus
Entry of Numeric Data
When a menu is being opened for numeric data entry, pressing the key enters numeric value 3.

■ Up Key

This key performs the following functions:
On normal echogram screen with no menu opened
Moving Variable Range Marker (VRM)

When the VRM is turned on (by pressing 5 SET ALARM), pressing the key moves it upward (toward shallowing direction).
On Menus
Selection of Menu Options
When a menu with two or more options is being opened, pressing the key selects those options downward. To complete the selection, press ENT MARK .

Setting Echo Threshold Level
Repeated keypress selects 4 levels of weak echo suppression starting with the strongest level.
Setting White Line Level
Repeated keypress selects 5 levels of bottom echo suppression starting with the weakest level.
Entry of Transducer Draft or Keel Offset
Repeated keypress reduces the entered value in 0.1 unit steps.
When data history window is opened
Selection of Retrieval Time Periods

When the data history window (PLAYBACK) is being opened (with 7 PLBK), pressing this key selects shorter retrieval time periods (24 hours □ 12 hours □ 6 hours □ 3 hours □ 1 hour □ 15 minutes). See para. 3.11 for details.

■ Left Key

On Menus
This key is used to select a total of 10 different colors for each echo strength level on the ECHO COLORS submenu (via MAIN MENU □ INSTALLATION SETTINGS) in the upward direction on the color sample strip while making settings via the menu system. Pressing returns to the previous color.

When data history window is opened When the data history window (PLAYBACK) is being opened (with 7 PLBK), pressing this key moves the vertical line cursor to the left on the time passage scale, showing the depth registered at the date and time (and the LAT/LON coordinates* and water temperature**) shown just below the scale.
* LAT/LON information is available with an optional GPS sensor plugged into the rear–panel I/O DATA connector.
** Water temperature readout is available when the specified dual frequency transducer is used or when an optional T–200 temperature sensor is plugged in to the rear–panel “TEMP” connector.

■ Down Key

This key performs the following functions:
On normal echogram screen with no menu opened
Moving Variable Range Marker (VRM)

When the VRM is turned on (by pressing 5 SET ALARM), pressing the key moves it downward (toward deepening direction).
On Menus
Selection of Menu Options
When a menu with two or more options is being opened, pressing the key selects

those options upward. To complete the selection, press ENT .
Setting Echo Threshold Level
Repeated keypress selects 4 levels of weak echo suppression starting with the weakest level.
Setting White Line Level
Repeated keypress selects 5 levels of bottom echo suppression starting with the weakest level.
Entry of Transducer Draft or Keel Offset
Repeated keypress increases the entered value in 0.1 unit steps.

When data history window is opened
Selection of Retrieval Time Periods

When the data history window (PLAYBACK) is being opened (with 7 PLBK), pressing this key selects longer retrieval time periods (15 minutes □ 1 hour □ 3 hours □ 6 hours □ 12 hours □ 24 hours). See para. 3.11 for details.

■ Clear Key CLR

On normal echogram screen with no menu opened screen
When an audible alarm is triggered (due to decreasing depth, missing bottom or decreasing power supply voltage), pressing this key silences the sound, while allowing a visual alarm indication to remain on screen.
On menus
When a number of menus are being displayed, pressing this key closes all menus and returns you to the normal echogram screen. Be sure to press ENT to complete any setting before pressing this key.
When the data history window is open
Pressing this key closes the window.

NOTE: Turning the equipment on while holding down this key resets the system, returning all user–made settings to the factory's defaults (initial settings), while retaining the sounding, date/time data etc. stored in the non–volatile memory.

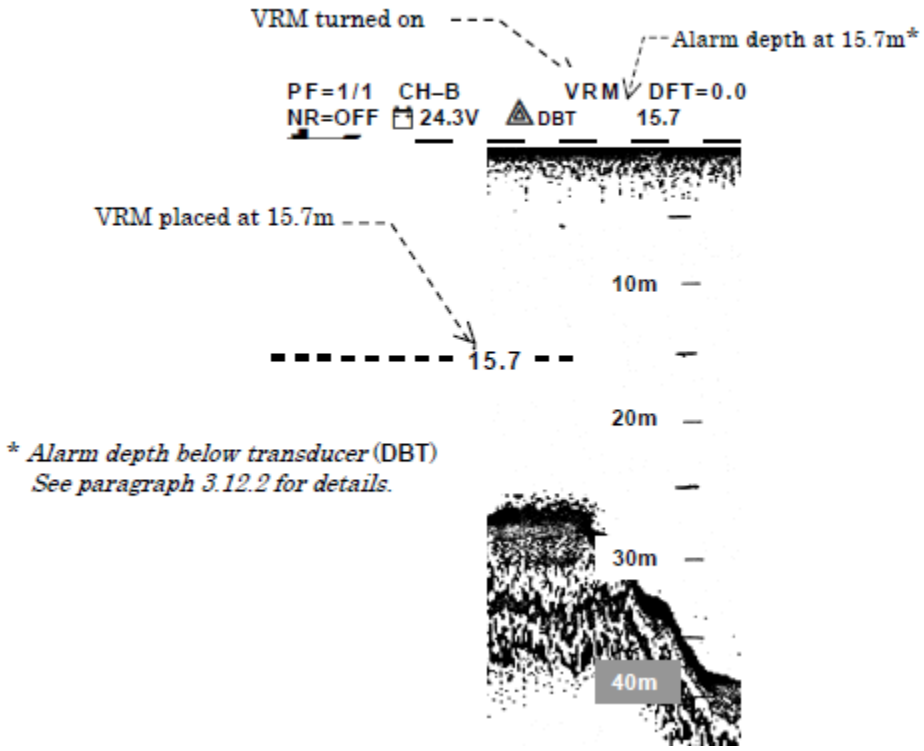
■ VRM Key 5 SET ALARM

This key performs the following functions:
On normal echogram screen with no menu opened
Turning on/off Variable Range Marker (VRM)
Pressing the key once turns on the VRM, a horizontal dotted line with depth indication to the right of its center, as in the example below. The appearance of "VRM" to the right of the frequency indication indicates that it is turned on. A second keypress turns it off.

The VRM is used to set the depth for the depth alarm, and can be shifted upward/downward by pressing ▲ / ▼.

Pressing ENT MARK fixes the alarm depth at the VRM position. See Figure 3-7 on next page for an example.

Figure 3-7 Variable Range Marker – Example

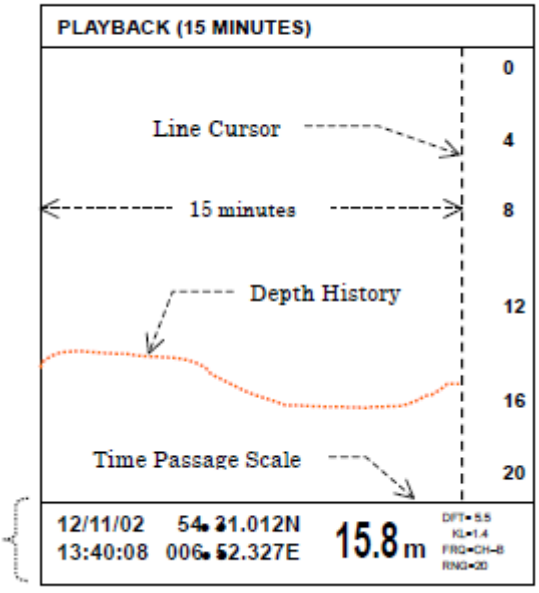


On menus
Entry of Numeric Data
When a menu is being opened for numeric data entry, pressing the key enters numeric value 5.

■ Playback Key 7 PLBK

This key performs the following functions:
On normal echogram screen with no menu opened
Pressing this key opens a data history (PLAYBACK) window in the left half screen, as in the example at right, in which the history of depth soundings over the

Figure 3-8 Data History Window – Example



past 15 minutes is shown graphically.
The various data at the line cursor position are shown in the bottom section of the window. The line cursor can be moved by pressing ▶ / ◀ .

Date, time, LAT/LON coordinates*, depth, draft, keel offset, maximum range, frequency at Line Cursor position

The time span, 15 minutes in the above example, can be changed by pressing ▲ / ▼. The following values are selectable: 15 minutes, 1 hour, 3 hours, 6 hours, 12 hours, and 24 hours. Refer to paragraph 3.11 for greater details.

To close the window, press CLR DEPTH ALARM or 7 PLBK again.

On menus

Entry of Numeric Data

When a menu is being opened for numeric data entry, pressing the key enters numeric value 7.

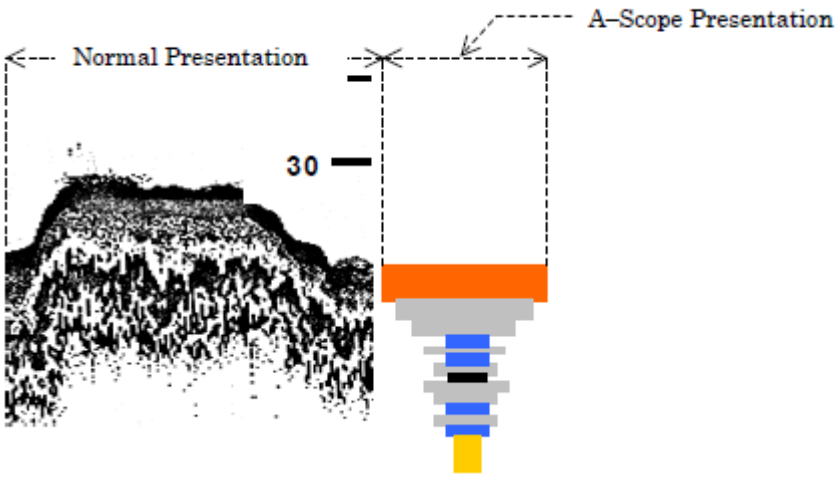
A–Scope Key 9/0 A-SCP

This key performs the following functions:

On normal echogram screen with no menu opened

Pressing this key activates an A–scope display across a small section from the screen right edge as shown in the example below. A second keypress turns it off.

Figure 3-9 A–Scope Function – Example



The A–scope display presents various echo strength levels in the form of horizontal deflections in addition to colors. The larger the deflection, the stronger the echo. The function helps estimate instantly an approximate size of an object as soon as it is detected, thereby eliminating the need to wait for the whole block of echoes to become visible across the screen. You will find the function useful when operating on deep ranges or at slow picture feed (PF) rates. See paragraph 3.4.4 for more details.

On menus
Entry of Numeric Data
When a menu is being opened for numeric data entry, pressing the key enters numeric value 9 or 0. A first press displays 9, and a second press, 0. To complete entry, press ENT MARK just after the desired value is shown.

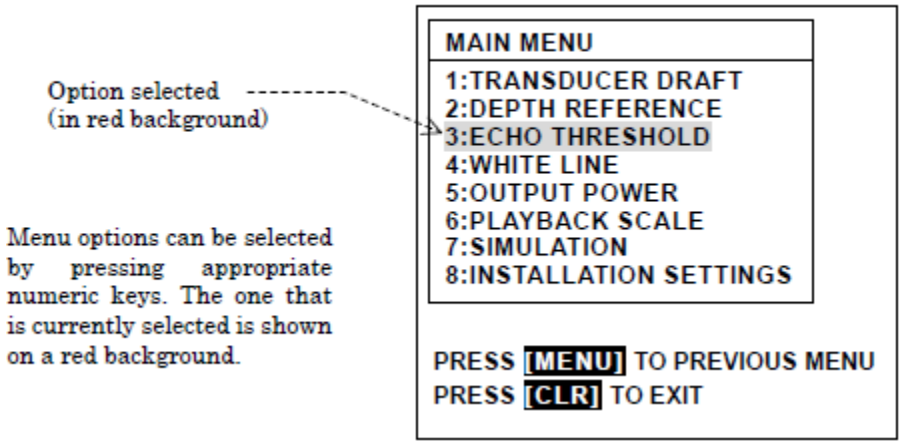
■ Brightness Key BRT DISPLAY

Pressing this key adjusts the screen brightness level in a total of 6 steps to suit the ambient lighting condition.

■ Menu Key MENU

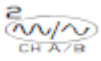
A first pressing of this key activates the menu system, opening a main menu (MAIN MENU), as illustrated below. A second keypress turns it off. The menu system allows you to make various settings that suit your operational requirements. Detailed instructions are given in section 4.

Figure 3-10 Main Menu



1:TRANSDUCER DRAFT: Enters transducer draft for channels A and B.
2:DEPTH REFERENCE: Selects references to which measured depth is to be referred (i.e., surface, transducer, or keel).
3:ECHO THRESHOLD: Selects weak echo suppression levels.
4:WHITE LINE: Selects bottom echo suppression levels.
5:OUTPUT POWER: Selects power levels automatically or manually.
6:PLAYBACK SCALE: Selects time scales when playing back stored data (soundings, date/time, channel, LAT/LON, etc.)
7:SIMULATION: Turns on/off built–in echo sounder simulator.

8:INSTALLATION SETTINGS: Opens a submenu with the following options:
1:ECHO COLORS: Assigns desired colors to echo strength levels.
2:DEPTH UNIT: Selects metric (m), fathom (FM), braccia (BR) or footage (FT) readout unit.
3:DYNAMIC RANGE: Selects echo dynamic ranges.
4:UTC/LST (offset): Selects UTC or local standard time (LST).
5:CLOCK PRESET: Presets built–in clock and calendar.
6:TEMPERATURE: Selects temperature readout units.
7:TRANSDUCER SETTINGS: Registers transducer location or keel offset.
8:DATA INPUT PORT: Selects input connectors to accept digital data input from external devices.
NOTE: Turning the equipment on while holding down this key for a few seconds displays a SYSTEM MENU for selection of background colors or for execution of hardware checks. See section 5 for details.

■ Channel Key 

This key performs the following functions:
On normal echo sounder screen with no menu opened
Switching Operating Channels and Display Page
A first keypress after power–up activates dual channel operation, splitting the screen into right and left halves, and showing echogram from one channel across the right half page and echogram from the other channel across the left half page. A second keypress switches the display back to the full screen page with echogram from the other channel. A third keypress splits the screen again with channel A and channel B displays exchanged. Pressing the key one more time returns the first full–screen display. This sequence is illustrated in Figure 3-12.

NOTE: Pressing

returns the full–screen single channel display directly.

Figure 3-11 Operating Channel Indication – Example

CH–A: channel A, CH–B: channel B

< CAUTION >
Operation at 200 kHz is not type–approved; therefore, the channel to which a 200 kHz trans–ducer is assigned must not be used for navigational purposes.

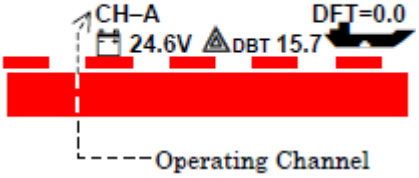
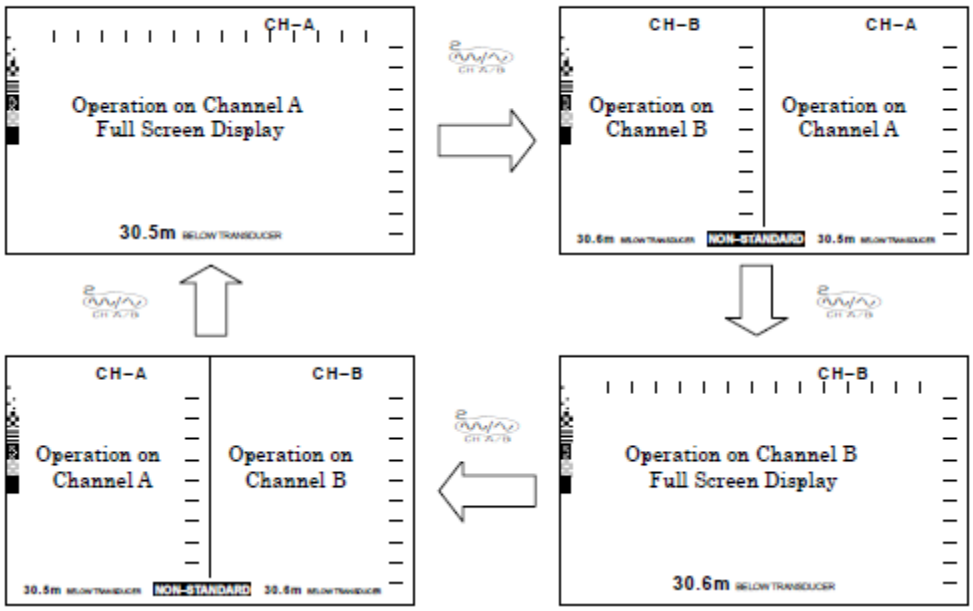


Figure 3-12 Switching Operating Channel and Dual Channel Display Format



On Menus

Entry of Numeric Data

When a menu is being opened for numeric data entry, pressing the key enters numeric value 2.

■ Auto Range Key

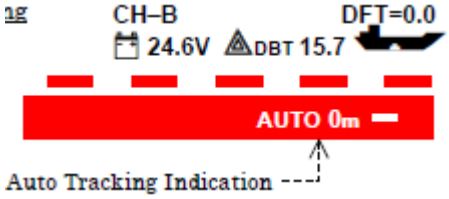
This key performs the following dual functions:

On normal echo sounder screen with no menu opened

Turning on/off Automatic Bottom Tracking

Pressing the key once enables depth ranges to be automatically selected so that the bottom echo shows up in the lower half screen at all times, despite of changes in depth. See paragraph 3.3.2 for details.

Figure 3-13 Auto Tracking Indication – Example



NOTE: The bottom echo must be shown in red, orange or yellow (or one of the three strongest echo colors, if you have change the color assignments) by adjusting the appropriate gain control before this function can be utilized.

On Menus

Entry of Numeric Data

When a menu is being opened for numeric data entry, pressing the key enters numeric value 4.

■ Right Key

On Menus

This key is used to select a total of 10 different colors for each echo strength level on the ECHO COLORS submenu (via MAIN MENU INSTALLATION SETTINGS) in the downward direction on the color sample strip while making settings via the menu system. Pressing returns to the previous color.

When data history window is opened

When the data history window (PLAYBACK, Figure 3-7) is being opened (with 7 PLBK), pressing this key moves the vertical line cursor to the right on the time passage scale, showing the depth registered at the date and time (and the LAT/LON coordinates* and water temperature**) shown just below the scale.

* LAT/LON information is available when an optional GPS sensor is plugged into, or external GPS data sentences are fed to, the I/O DATA connector.

** Water temperature readout is available when the specified dual frequency transducer is installed or when an optional temperature sensor is plugged in to the TEMP connector.

■ Enter Key ENT

This key performs the following functions:

On normal echogram screen with no menu opened

Placing Line Marker & Initiating Storage of Current Graphic Screen

Pressing the key during normal sounding operation draws a red line marker vertically across the screen together with the current date/time and LAT/LON* stamping. At the same time, the right half of the current echogram is stored in memory. It can be recalled onto the left half screen by pressing MODE and can be output to a printer for a monochrome hard copy of the stored echogram via a HARD COPY menu that pops up when the key is pressed.

* An optional GPS sensor or external GPS data source is required.

On Menus

Completing User–Made Settings or Selection of Menu Options

When you are making a setting or selecting menu options, pressing the key completes that setting or selection of that option.

■ Picture Feed Key 6 PLOT SPEED

This key performs the following functions:

On normal echo sounder screen with no menu opened

Selection of Echogram Feed Rate

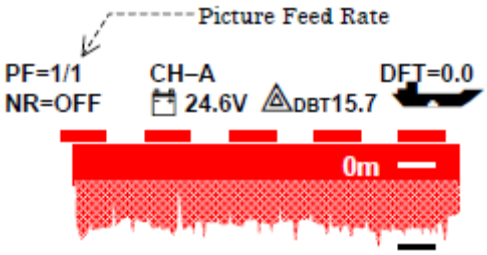
Repeated pressing of the key selects the following echogram (picture) feed (PF) rates:

PF=1/1: Feeds echogram once every transmission. (fastest rate)

PF=1/2: Feeds echogram once every 2 transmissions.

PF=1/4: Feeds echogram once every 4 transmissions.
PF=1/8: Feeds echogram once every 8 transmissions.
PF=1/16: Feeds echogram once every 16 transmissions. (slowest rate)
PF=STOP: Freezes echogram feeding while sounding continues.

Figure 3-14 Picture Feed Rate Indication – Example

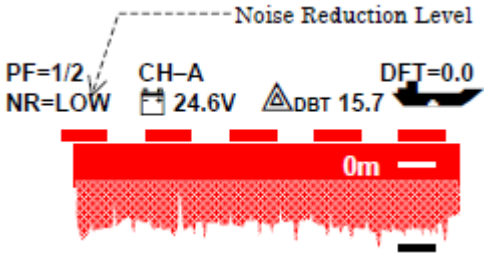


If you wish to monitor the current echogram for longer periods of time, select one of slower rates. The current sounding rate (i.e. depth readout updating intervals) remains unchanged regard– less of the PF rate selected.
On Menus
Entry of Numeric Data
When a menu is being opened for numeric data entry, pressing the key enters numeric value 6.

■ Noise Reduction Key

This key performs the following functions:
On normal echo sounder screen with no menu opened
Reduction of Noise Interference
Repeated pressing of the key activates the function of reducing the effect of noise interference coming from other onboard electronics or nearby echo sounders.
The following levels of noise reduction (NR) are selectable:
NR=LOW: Selects low reduction level.
NR=MID: Selects mid reduction level.
NR=HIGH: Selects high reduction level.
NR=OFF: Terminates the function (default).

Figure 3-15 Noise Reduction Level Indication – Example



On Menus
Entry of Numeric Data
When a menu is being opened for numeric data entry, pressing the key enters numeric value 8.

■ Keypad Dimmer Key DIM KEYBOARD

Repeated pressing of this key reduces the keypad backlighting level in steps. After the minimum level is reached, further keypress returns the maximum level.

■ Power Key POWER

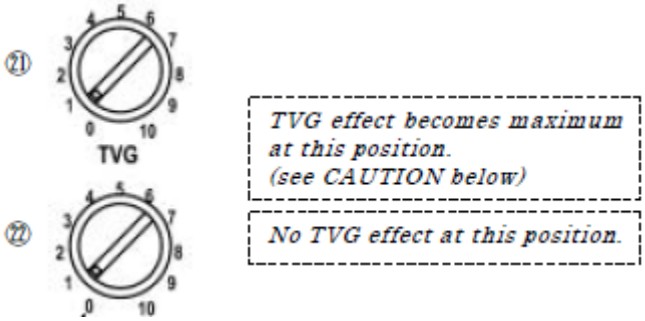
This key turns on/off the equipment.
To turn it on, lightly touch the key, release it, and then wait for a few seconds (until you hear a single beep.
To turn it off, press and hold down the key for a few seconds (until you hear a series of beeps – two slow beeps followed by two quick beeps). This delayed action is intentional, preventing accidental shutoff.

Turning it on while holding down CLR DEPTH ALARM resets the equipment, returning all user–made settings to the factory's defaults.
Turning it on while holding down MODE displays a SYSTEM MENU, from which you can select background colors or can perform memory checks..

㉑ TVG Control (for operation on channel A)

㉒ TVG Control (for operation on channel B)

Controls ㉑ and ㉒ are time–varied gain (TVG) controls for high and low frequency operations, respectively. Each control is designed to reduce surface clutters (strong noise echoes near the waterline), thereby preventing them from disturbing digital depth reading or automatic bottom tracking without affecting the sensitivity necessary for bottom detection. This function is achieved by abruptly suppressing the receiver gain at the start of each transmission and gradually recovering it as transmitted energy travels deeper toward the bottom. At its fully counterclockwise (CCW) position, the TVG control provides a greatest level of initial gain suppression. When turned fully clockwise (CW), it produces no TVG effect.
If you experience difficulty with digital depth reading or automatic bottom tracking at normal gain settings, turn the appropriate TVG control in CCW direction to correct the problem. See paragraph 3.10 for additional information on TVG settings.

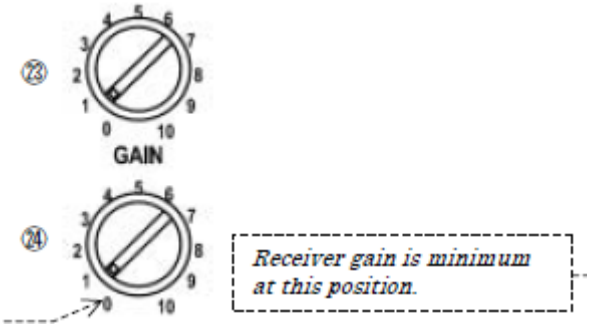


< CAUTION >
With the TVG control at its CCW position during shallow water operation, no bottom echo or extremely weak bottom echo may be received.

㉓ Gain Control (for operation on channel A)

㉔ Gain Control (for operation on channel B)

Controls ㉓ and ㉔ are receiver gain controls for high and low frequency operations, respectively. Clockwise rotation increases the gain level, resulting in echoes showing in stronger colors (red, orange, yellow, etc.).
For stable digital depth reading or automatic bottom tracking operation, adjust the gain so
that the bottom echo shows in red, orange or yellow (or one of the three strongest echo colors, if you have changed the color assignments). The TVG level (shallow gain suppression level) may also have to be increased (by turning the appropriate control, ㉑ or ㉒ in CCW direction) to prevent surface clutters from disturbing digital depth reading. See paragraph 3.9 for additional information on gain settings.



1.3.3. Selecting Depth Ranges

1.3.3.1. Manual Selection

A total of eight depth ranges, illustrated in the figure below, can be selected by repeatedly pressing 1 DEPTH RANGE / 3 .

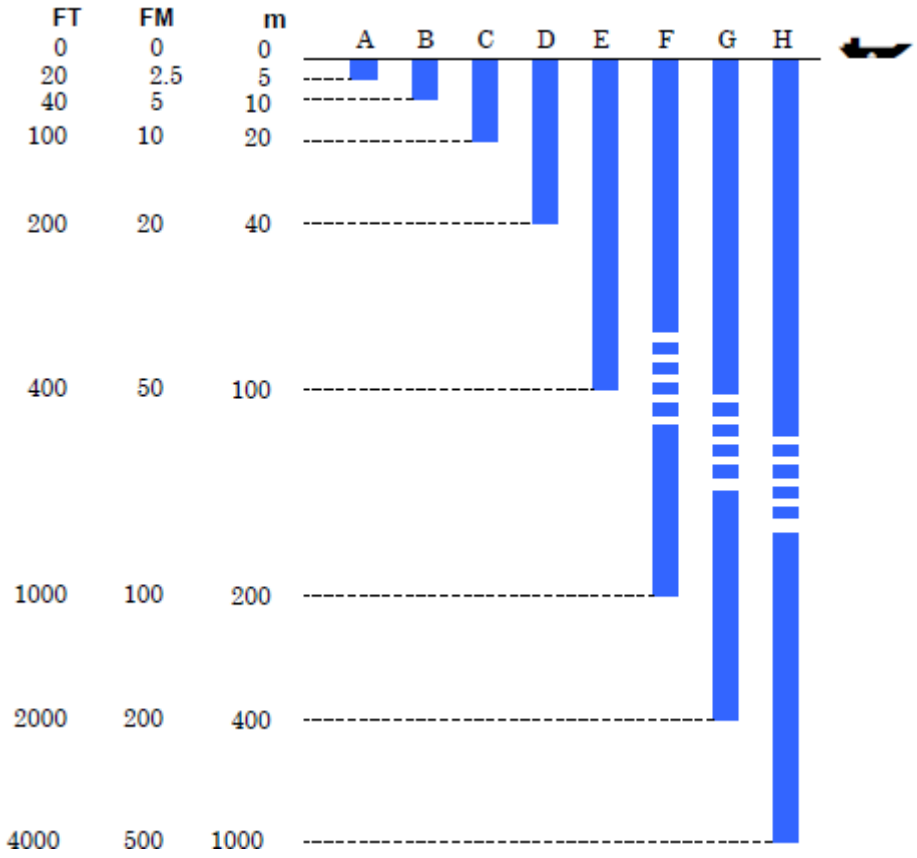
1 DEPTH RANGE : Selects smaller ranges (in H–to–A direction).

3 : Selects larger ranges (in A–to–H direction).

All depth ranges start at scale line zero (0), unless a transducer draft* or keel offset** is entered. No phased depth ranges are available. *Paragraph 4.2 **Paragraph 4.9.8.3. Select depth ranges so that the bottom echo is displayed, preferably within the lower half part of the screen for ease of monitoring the changing depth graphically. If the

depth exceeds the current range limit, a missing–bottom alarm will be triggered. See paragraph 3.12.3 for details.

Figure 3-18 Depth Range Arrangement

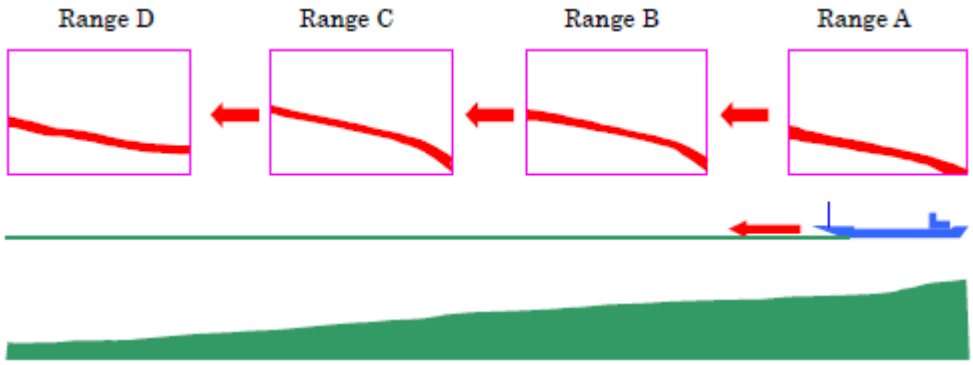


1.3.3.2. Automatic Selection

Pressing 4 AUTO RANGE will enable the equipment to select depth ranges automatically so that the bottom echo will always be displayed in the lower half screen area despite of changes in depth. The figure below illustrates an example of how depth range selection occurs with this function activated, as you travel over a gradually deepening bottom. As soon as the bottom shows up at the lower end of the scale lines on the current depth range, the next greater range will be automatically selected. When traveling over a gradually shallowing bottom, the range selection sequence is reversed. As soon as the bottom is registered in the upper half screen, the next smaller range will be switched in. To take advantage of the function, you must adjust the appropriate gain control (for the currently active frequency) so that the upper part of the bottom echo is shown in red, orange or yellow (or in one of the three strongest echo colors if you changed the echo color assignment).

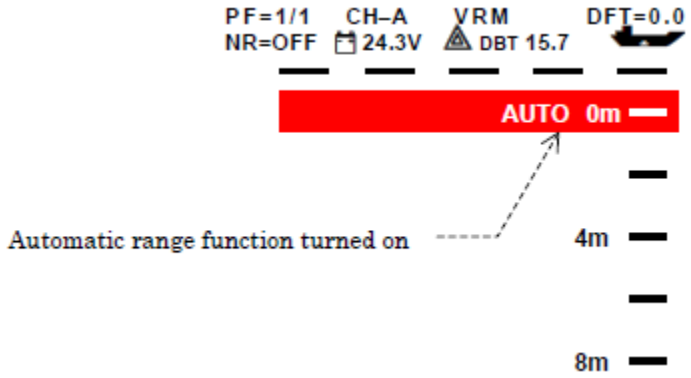
To terminate the function, press 4 AUTO RANGE again or press 1 DEPTH RANGE / 3 .

Figure 3-19 Automatic Depth Range Selection – Example



On–screen status indication “AUTO” will be turned on to the left of the top scale line to indicate that the function is currently activated, as in the example below.

Figure 3-20 On–Screen Indication of Automatic Ranging



1.3.4. Interpreting Echo Display

1.3.4.1. Bottom Echo Colors

The bottom echo will be displayed in up to seven different colors – initially, red, orange, yellow, green, yellowish green, light blue and blue, which represent the various layers of the bottom stratum in order of strength. Namely, red represents the strongest level, and blue, the weakest one. A colored bar (termed “color scale” in this manual) located at the left end of the screen indicates the colors that are currently assigned to display echoes, as in the figure below. You can change those color assignments using a total of 10 different colors. See paragraph 4.9.2 for instructions.

Figure 3-21 Initial Assignments of Bottom Echo Colors

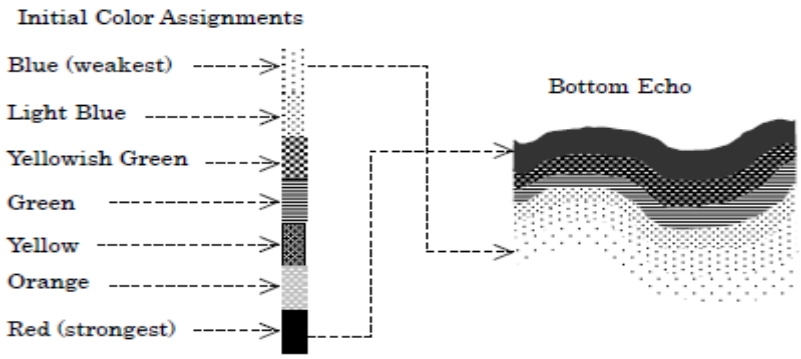
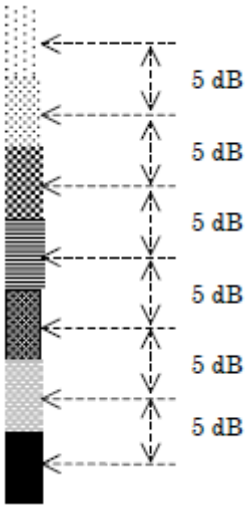


Figure 3-22 Initial Echo Dynamic Range



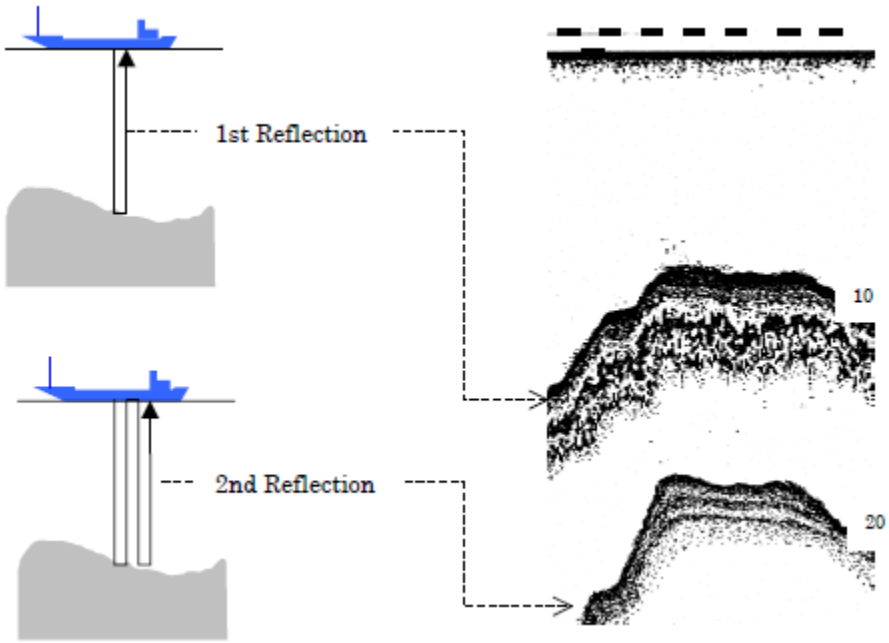
There is initially an approximately 5 dB difference in strength between two adjacent colors, as illustrated in the figure at right, meaning that a particular color is approx. 1.8 times stronger or weaker than either adjacent color. This difference, called the echo dynamic range, can be changed to suit various bottom conditions (hard, soft, muddy, etc.). See paragraph 4.9.4 for instructions.

1.3.4.2. Multiple Bottom Echoes

When navigating a shallow water area, you may observe a bottom–like echo at twice the present depth, and sometimes also at three or four times the depth. This multiple echo phenomenon occurs when the first echo is reflected back and forth a number of times between the water surface and the bottom like reverberations. In the case of the example below, a first reflection, which is used to register the depth, is bounced back to the bottom, and then back again to the transducer as a second reflection, thereby causing that echo to be recorded at twice the depth. The appearance of multiple bottom echoes indicates that the bottom is relatively hard.
The effect of multiple reflections may be reduced by decreasing the receiver gain (through gain and/or TVG adjustment, paragraphs 3.8 and 3.9) or by reducing transmit power output (paragraph 4.6). To display the digital depth readout correctly or to utilize the automatic bottom tracking function (automatic depth range selection),

however, the first echo must remain in red, orange or yellow (or in one of the three strongest colors if you change the echo color assignments). Occasionally a large school of fish or a temperature layer can also cause the equipment to lock onto it, thus producing an incorrect digital depth readout. Whenever you have any doubt about the validity of digital depth reading, check the depth graphically against the on–screen scale calibrations to determine whether the current digital readout is valid or not. A special caution should be exercised when using digital depth information while in shallow water operation because the second echo may be tracked for depth measurement, resulting in a digital readout twice the actual depth.

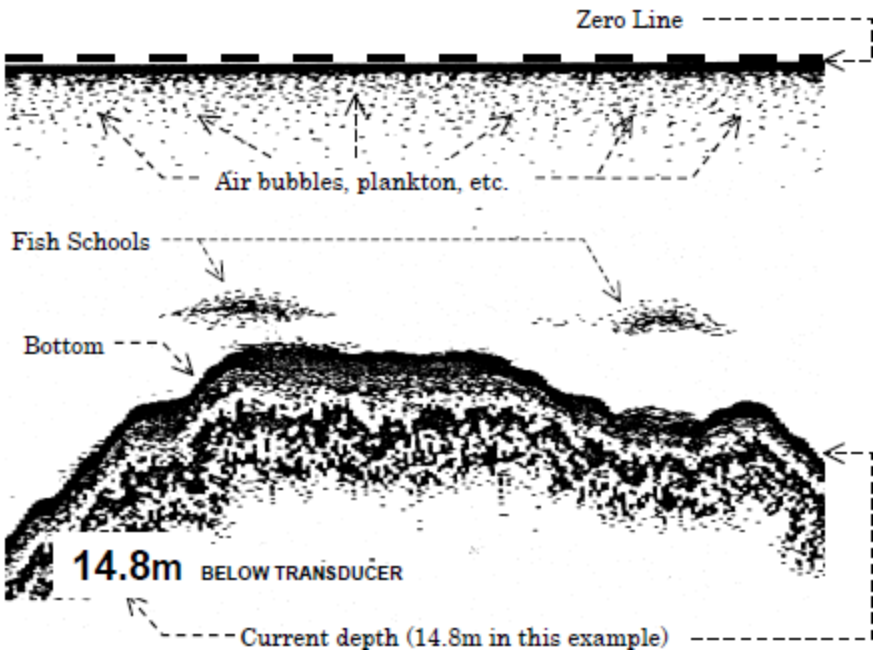
Figure 3-23 Multiple Bottom Echo Display – Example



1.3.4.3. Other Echoes

In addition to the bottom echo (and its multiple echoes), the equipment will show echoes from fish schools, temperature layers, and various tiny objects, like plankton concentrations and air bubbles. The figure below is an example of how such echoes show up on the screen. A thick line appearing in the strongest echo color at the upper edge of the echo display area is called a zero line, which is caused by a portion of transmitted ultrasonic power being leaked into the receiver. It represents the position on the screen of the transducer. When a transducer draft is entered (paragraph 4.2), the zero line shifts down from the top scale calibration mark (scale 0) by the amount of the draft. When a keel offset is entered (paragraph 4.9.8.3), the zero line occurs above scale 0, and its display is suppressed.

Figure 3-24 Typical Shallow Water Echo Display – Example



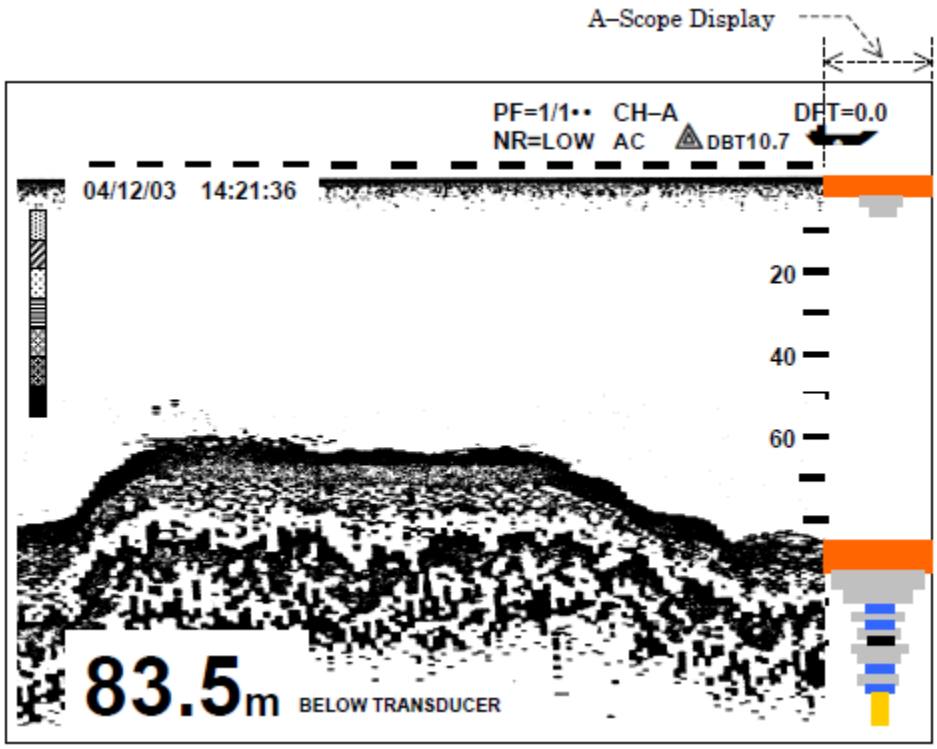
< WARNINGS >

1. A LARGE FISH SCHOOL, ESPECIALLY ONE LOCATED AT SHALLOW DEPTHS, CAN OCCASIONALLY PRODUCE AN EXTREMELY STRONG ECHO, CAUSING THE EQUIPMENT TO LOCK ONTO THAT ECHO AS THE BOTTOM ECHO. AN INCORRECT DIGITAL DEPTH READOUT WILL OCCUR AS A RESULT. IN SITUATIONS WHERE ACCURATE DEPTH INFORMATION IS OF VITAL IMPORTANCE, BE SURE TO CONFIRM THE READOUT BY COMPARING IT WITH THE ON–SCREEN BOTTOM ECHO LOCATION. TOTAL RELIANCE ON THE DIGITAL DISPLAY IS DANGEROUS AND MUST BE AVOIDED, ESPECIALLY WHEN TRAVELING IN SHALLOW WATER AREAS.
2. WHEN OPERATING IN SHALLOW WATER AREAS, THE EQUIPMENT MAY OCCASIONALLY LOCK ONTO THE SECOND BOTTOM ECHO, READING TWICE THE ACTUAL DEPTH. BE SURE TO COMPARE THE ON–SCREEN BOTTOM ECHO POSITION WITH THE DIGITAL DEPTH READOUT WHENEVER NAVIGATING SHALLOW WATER AREAS OR WHENEVER THE DIGITAL READOUT IS QUESTIONABLE. SEE PARAGRAPHS 3.4.2 AND 4.6 FOR RELATED INFORMATION.

1.3.4.4. A–Scope Presentation of Echoes

A–scope is a format of echo presentation, showing various echo strength levels in the form of horizontal deflections, as well as in colors. An example of A–scope display is given below. The size of deflection represents a relative strength level, i.e. the greater the deflection, the stronger the echo.

Figure 3-25 Typical Echo Sounder Screen with A–Scope Turned on – Example



To turn the A–scope display on, simply press A-SCP. To turn it off, press the key again.

The A–scope display will help estimate instantly an approximate size of an object as soon as it is detected, thereby eliminating the need to wait for the whole block of echoes to become visible across the screen. You will find the function useful when operating on deep ranges or at slow echogram feed rates.

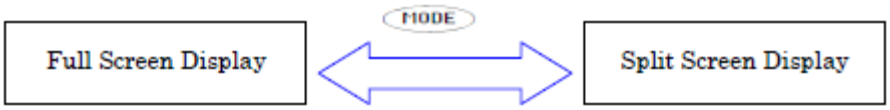
1.3.5. Selecting Display Modes

The following display modes are selectable by repeatedly pressing MODE as illustrated in the figure below.

Full screen echogram display

Split screen display* with right half area showing echogram of current sounding and left half showing graphic data** recalled from memory.

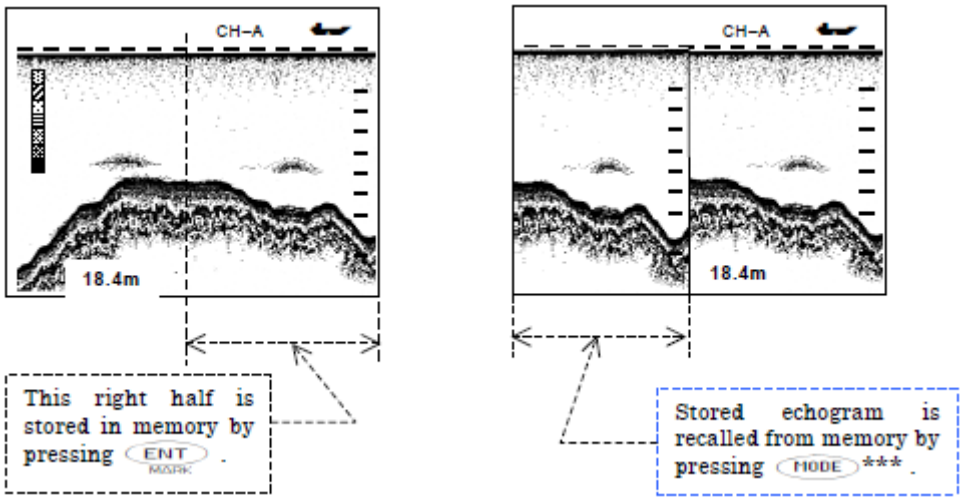
Figure 3-26 Selecting Display Modes



* Split–screen display is available also when dual channel operation is activated. See paragraph 3.7 for details..

** The right half of the current echogram can be stored in memory (by pressing ENT MARK) and recalled across the left half screen area.

Figure 3-27 Typical Full Screen and Split Screen Displays


CH-A
18.4m
This right half is stored in memory by pressing ENT MARK .
CH-A
18.4m
Stored echogram is recalled from memory by pressing MODE *** .

** A HARD COPY menu pops up briefly over the recalled echogram display for printout of the stored echogram. Refer to paragraph 3.6 for details.

A second press of MODE returns to the full screen display.

< CAUTION >

The stored graphics data will be erased from memory when the equipment is turned off.

1.3.6. Printing Out Echogram Screen

When a graphics printer* is plugged into the rear panel connector “PRINTER,” the right half of the current echogram screen can be printed out in monochrome.

* DOS/V–compatible printer supporting ESC/P protocol, such as OKI Microcline 280

To obtain a screen hard copy, proceed as follows:

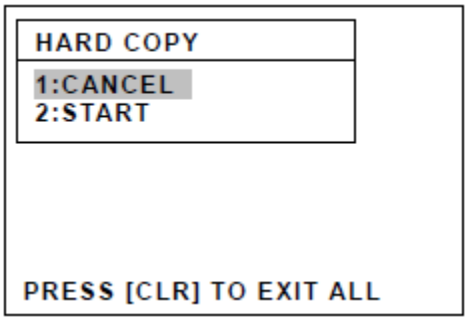
Set the printer ready. Make sure that the “SEL” lamp glows continuously and the “PE” lamp is turned off.

Press ENT MARK , storing the right half section of the current echogram into memory.

Press MODE to show the stored echogram across the left half screen.

The following menu will pop up over the recalled echogram, asking you to select the action you wish to execute. The options are self–explanatory.

Figure 3-28 HARD COPY Menu



NOTE: The above menu will be turned off automatically in approximately five seconds unless an option is selected.

Select option “2:START” by pressing 2 key (or by pressing ▲ /.. ▼,

followed by ENT).

It will take 7 to 15 minutes to complete the printing.

Press MODE or CLR again to turn off the recalled echogram.

< CAUTION >

Stored or recalled echogram will be lost when the equipment is switched off.

1.3.7. Switching Transducers (Operating Channels)

1.3.7.1. Introduction

In a DEBEG 4630 system where two transducers are plugged in, you can:
switch them to monitor the depth from each location across the full screen area, or split the screen into right and left halves to monitor the depth from one transducer across the right half area and the depth from the other transducer across the left half area.

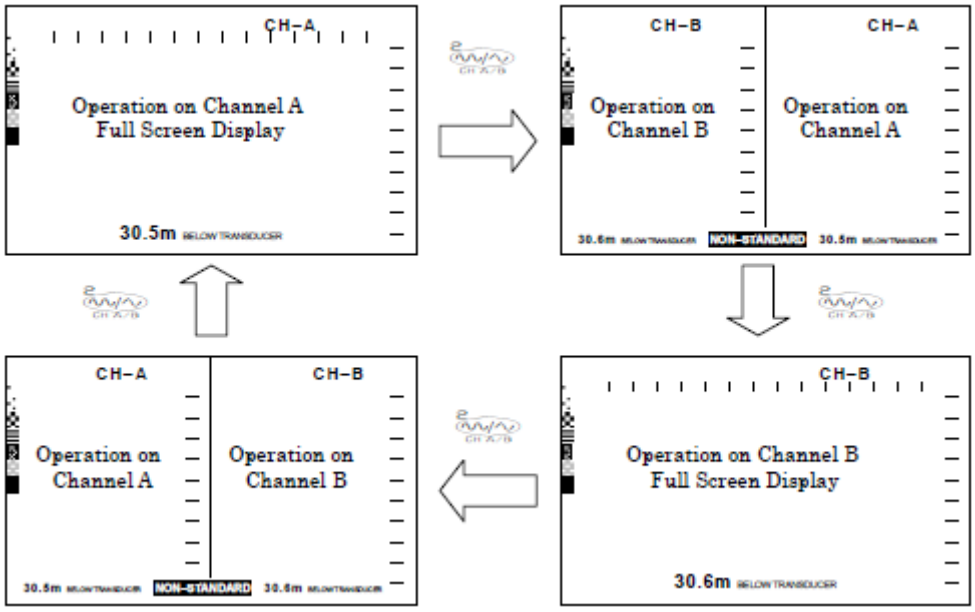
Each transducer is assigned a specified channel name (channel A or channel B) by the r installer (or by the operator) at the initial setup time. Channel A (identified as CH–A on the screen) is initially assigned to a high frequency transducer, and channel B (CH–B), to a low frequency transducer. See the “Channel–Transducer Assignments” table on page for actual assignments in your system.
To switch between channel A and channel B or between single channel (full screen) operation and dual channel (split screen) operation, repeatedly press 2, as in the example illustrated below.

< CAUTION >

Dual channel operation (i.e., dual frequency operation) does not comply with the relevant IMO resolution and should not be used for navigational purposes. To warn the operator of this non–compliant usage, a warning message

"NON–STANDARD" is turned on highlighted at the screen's bottom near the partition during dual channel operation.

Figure 3-29 Switching Channels and Single/Dual Channel Operation – Example

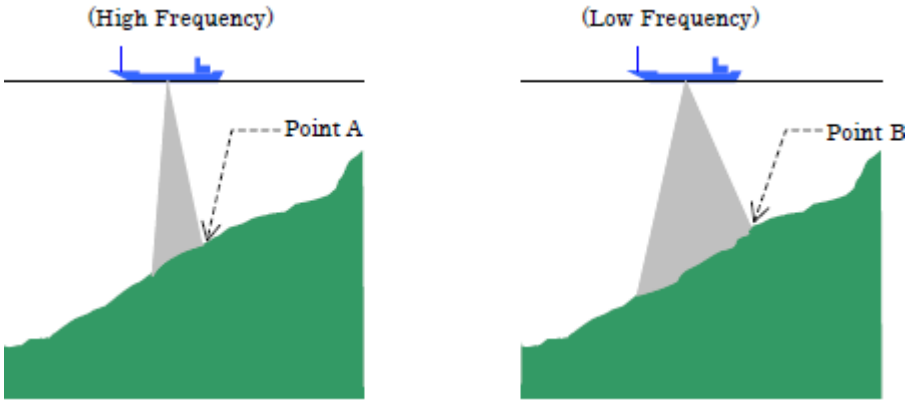


NOTE: Pressing MODE returns the full–screen single channel display directly.

1.3.7.2. Selecting Channels (Transducer Frequencies)

The depth readout may be slightly different between high frequency sounding and low frequency sounding. This phenomenon is due mainly to the difference in:
the width of ultrasound beam between the two transducers. (See illustration below)
the acoustic characteristics of the bottom stratum between the two frequencies
Low frequency operation will usually result in registering a thicker bottom echo than high frequency operation because of a wider beam coverage.

Figure 3-30 Transducer Beam Width Affecting Depth Measurement – Example



In the above example, point "A" to be registered as depth on high frequency echogram will be deeper than point "B" to be registered as depth on low frequency echogram due to narrow coverage of high frequency beam. See paragraph 9.2.3 for information on beam widths of the transducers.

1.3.7.2.1. High Frequency Operation

High frequency (100 kHz or 200* kHz) sounding uses a narrow beam transducer, thereby producing relatively satisfactory results under the following situations:
 where good echo resolution is required.
 where a better accuracy or a smaller detectable depth is required at shallow depths.
 where the bottom echo is often lost under heavy sea conditions, or when the ship is traveling in the wake of another vessel or going astern.

*< CAUTION >

Operation at 200 kHz is not type–approved for navigational purposes.

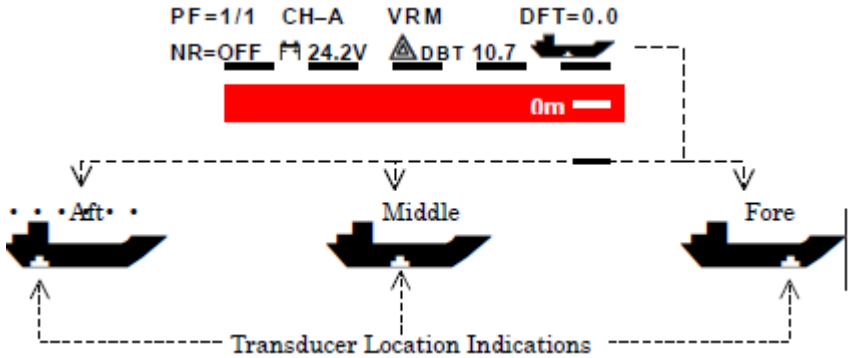
1.3.7.2.2. Low Frequency Operation

Low frequency (normally 50 kHz) operation uses a wide beam transducer with inherent extended depth–penetrating capability, thereby producing relatively satisfactory results under the following situations:
 where good echo sensitivity is required in deep water sounding.
 where operation takes place in deep water areas (in excess of 200 meters) most of the time.

1.3.8. Indication of Transducer Location

If your echo sounder system has two separate transducers (for channel A and channel B) installed at different locations (middle, fore or aft location in an alongships direction), a ship–shaped icon just above the top scale line graphically is provided to indicate the relative location of the transducer currently in use for sounding, as in the example below.

Figure 3-31 Indication of Channel A Transducer Location – Example



To utilize this function, you must first register the relative location of each transducer via the menu system. Refer to paragraph 4.9.8.2 for instructions.

1.3.9. Adjusting Receiver Gain Controls

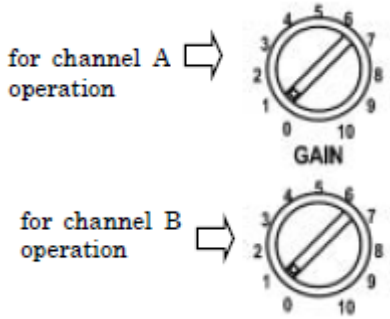
The receiver gain control for each channel illustrated at right. Each control adjusts the rate of amplification of echo signals. For stable digital depth reading or automatic bottom tracking operation, adjust the gain so that the bottom echo is always displayed in red, orange or yellow (or one of the three strongest echo colors, if you have changed the color assignments*). The TVG** level (shallow gain suppression level) may also have to be increased to prevent surface clutters from disturbing digital depth reading.

* See paragraph 4.9.2 for details on user–definable colors.

** See paragraph 3.10 for details.

Lack of receiver gain will cause the missing–bottom alarm to be triggered. See paragraph 3.12.3 for information on the alarm.

Figure 3-32 Receiver Gain Controls

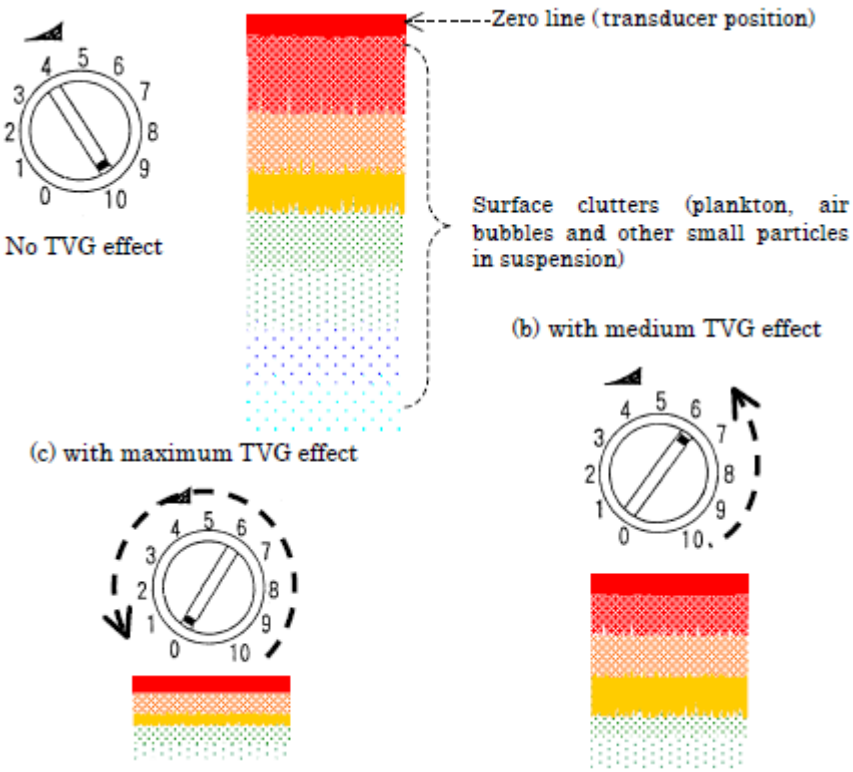


1.3.10. Adjusting TVG Controls

TVG stands for time–varied gain. The TVG control is designed to sharply drop the receiver gain on each transmission, and then gradually recover the normal gain level as the transmitted signal travels deeper toward the bottom. When the control is set fully counterclockwise, both the amount of initial gain drop (or initial gain suppression) and the range of TVG effectiveness are at a maximum level. As you turn the control in the clockwise direction, the amount of suppression and range will decrease. No TVG effect is available with the control fully clockwise. In situations where digital depth reading is intermittent or automatic bottom tracking operation is erratic despite of the bottom echo showing in red, orange or yellow (or in three user–defined strongest colors), suspect that surface clutters (explained below) are responsible, forcing such echoes to be accepted as a random bottom echo. To correct the problem, turn the appropriate TVG control in CCW direction until normal readout or bottom tracking function is restored or until such echoes become visible in weaker colors while keeping the bottom reflection in the same (three strongest) colors by slightly increasing the gain as necessary.

Figure 3-33 Adjusting TVG Level – Example

(a) Reflections near transducer face with no TVG effect


Zero line (transducer position)
Surface clutters (plankton, air bubbles and other small particles in suspension)
No TVG effect
(b) with medium TVG effect
(c) with maximum TVG effect

CAUTION: With TVG control fully CCW during shallow depth operation, extremely weak bottom echo may result.

1.3.11. Retrieving Data History

1.3.11.1. Introduction

The equipment automatically stores depth, UTC date and time, maximum depth range used, frequency* (operating channel) used, and position data** for a 24–hour period at intervals of two seconds. The following instructions enable the user to retrieve such data via an on–screen graphical user interface called the "data history window."

* Frequency data will be stored in the form of channel ID "CH–A/B" , and not in actual frequency values.

** LAT/LON coordinates data will be stored when an appropriate GPS sensor is plugged into the rear panel I/O DATA connector.

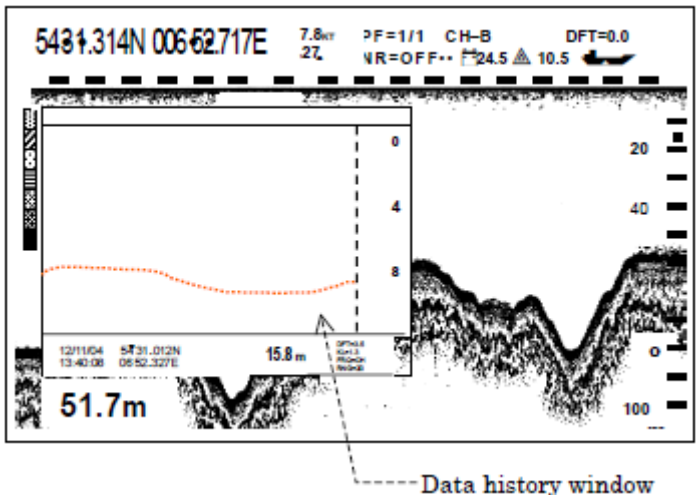
3.11.2. Displaying Data History Window

To display the data history window, simply press 7 PLBK * . It will show up over the left half area on the screen, as an example below. A second keypress** turns the window off. The rest of the keys can be used normally to perform their assigned functions while the window is being opened.

*When a menu is being shown, the 7 PLBK key acts as the numeric key to enter the numeric value of 7.

** Pressing CLR also closes the window.

Figure 3-34 Echo Sounder Screen with Data History Window Opened – Example



A close–up view of a typical window is given in Figure 3–34. Data registered over the past 15 minutes, 1 hour, 3 hours, 6 hours, 12 hours and 24 hours can be retrieved. The history of depth soundings will be displayed graphically relative to the above time (PLAYBACK) scales as well as digitally via the procedures detailed in the following paragraphs.

Once shown in the window, the data will not be automatically updated, though the current data will be continuously stored in memory. To update the data in the window, close the window first by pressing CLR DEPTH ALARM , and then open it again by pressing 7 PLBK .

3.11.3. Retrieving Data Registered at Specific Date/Time

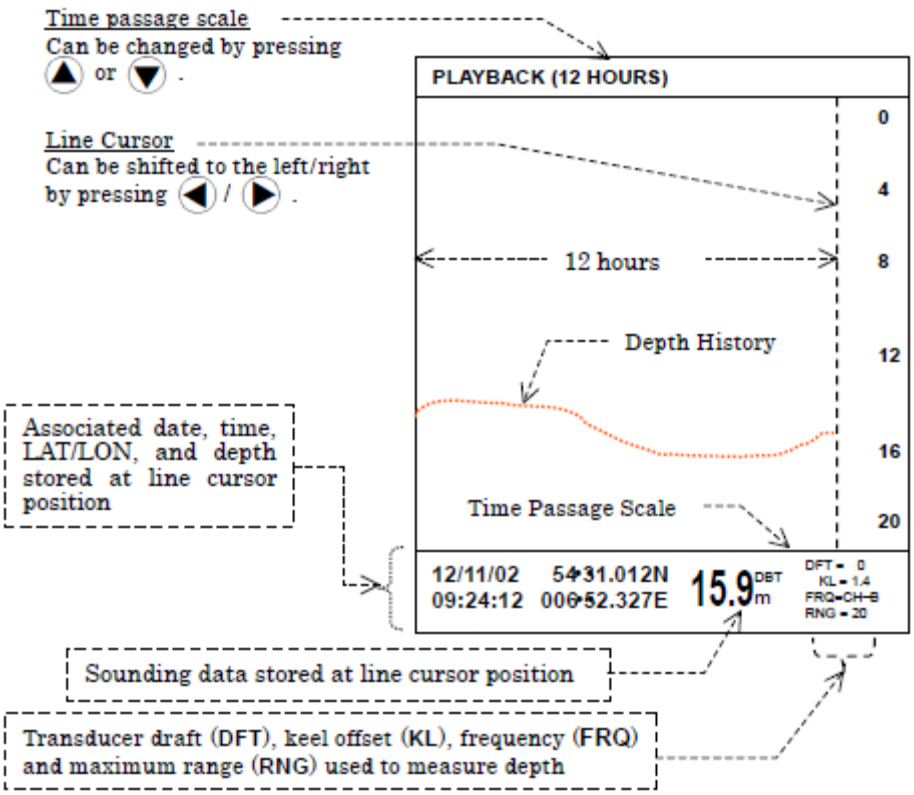
An example data history window is illustrated below where the vertical axis represents the depth scale and the horizontal axis, the time passage. The history of soundings over the past 12 hours is displayed graphically, while the rest of the data stored at the line cursor position are digitally shown at the bottom of the window, as in the example below.

IMPORTANT

If, for any reason, the equipment was switched off before current operation, all previous data saved until that moment will be displayed in blue, while the data collected during current operation will be in white, indicating that discontinuity in time exists in the data being displayed.

To change the time passage scale (PLAYBACK scale), press ▲ or ▼ . The current scale is shown just above the upper edge of the window, as in the example.

Figure 3-35 Data History Window – Example



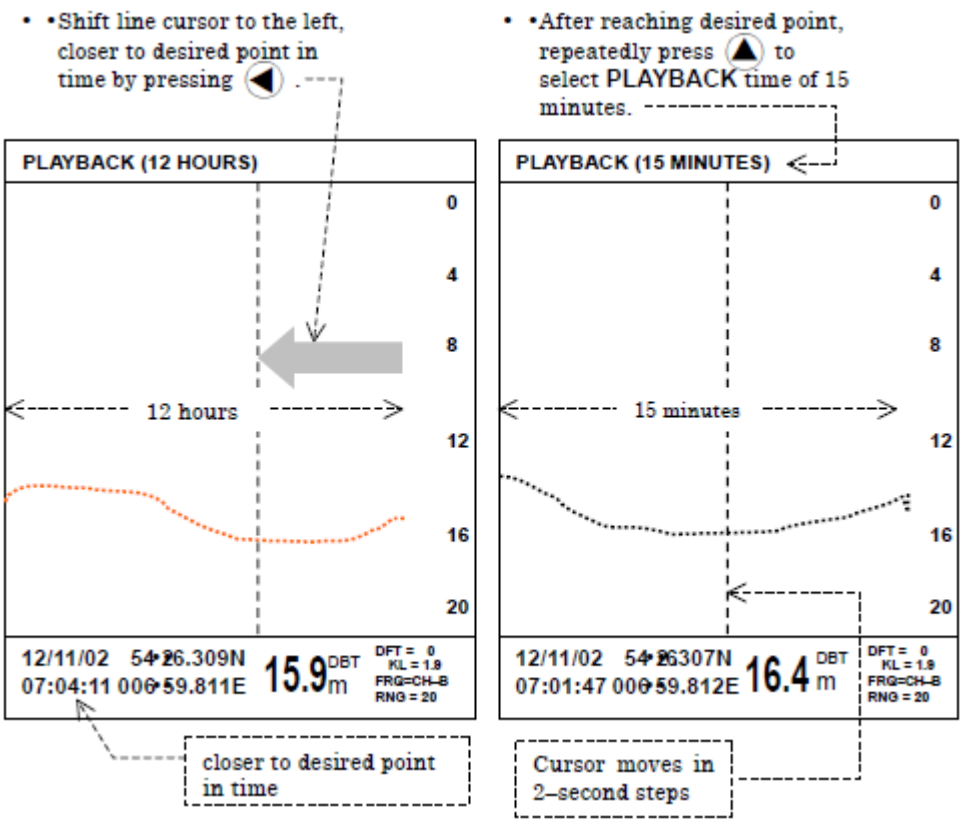
The various data at the line cursor position are shown in the bottom section of the window. The line cursor can be moved by pressing / .The time span, 12 hours in the above example, can be changed by pressing / . The following values are selectable: 15 minutes, 1 hour, 3 hours, 6 hours, 12 hours, and 24 hours.

To close the window, press PLBK again or CLR .

1.3.11.4. Reviewing Data History in Detail over Specific Section

On a large time scale, such as 24 hours or 12 hours, the line cursor moves in large steps, such as 5 min. steps on 24–hour scale or 2 min.24 sec. steps on 12–hour scale, making it difficult to review the data history over a 15–minute section of a specific point in time. This shortcoming can be corrected by first shifting the line cursor close to the desired point in time (□), and then selecting the smallest time scale (□), as in the example below. You can now check the data in 2–second steps over the 15 minute section centered on the cursor position.

Figure 3-36 Reviewing Data History in Detail on Long Time Scale – Example



Indication of Data Continuity/Discontinuity

If the color of the depth graphics and numeric data changes from white to blue or vice versa at a specific point in time while moving the line cursor, it indicates that the equipment was turned off at that point and that there is discontinuity in the data being displayed. The data stored until the power removal/shutoff are shown in blue, while the data from current operation are in white.

Deriving Stored Data for PC–Based Applications

The data stored in memory can be uploaded to PC–based applications. See section 6 for instructions.

1.3.12. Alarms

1.3.12.1. Introduction

To meet the alarm requirements* stipulated in the IMO Resolution for Navigational Echo Sounding Equipment, the following alarms are incorporated and enabled at all times while the equipment is switched on.

 Depth: Warns against decreasing depth. (Audible and visual indications)

 Missing Bottom**: Warns against bottom echo being lost, becoming too weak for depth measurement, or exceeding current range limit. (Audible and visual indications)

 Power Failure: Warns against drop of power supply voltage below factory–specified level. (Audible and visual indications)

 Power Removal: Warns against removal or shutoff of power source. (Audible

indication only).
* Paragraph paragraphs 5.3.1 and 5.3.2. of MSC.74(69), Annex 4
** This alarm is not a requirement in the IMO resolution MSC.74(69).

1.3.12.2. Depth Alarm

1.3.12.2.1. Setting Alarm Depth

To utilize this function, you must set the alarm depth first, via the following steps.

Figure 3-37 Setting Alarm Depth – Example

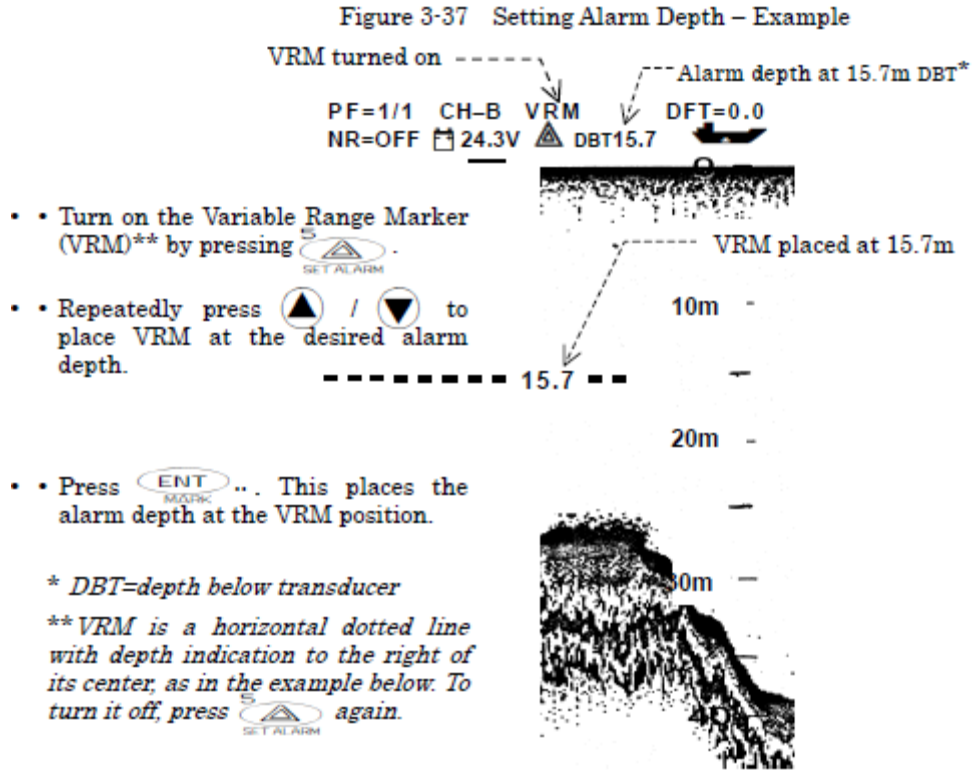
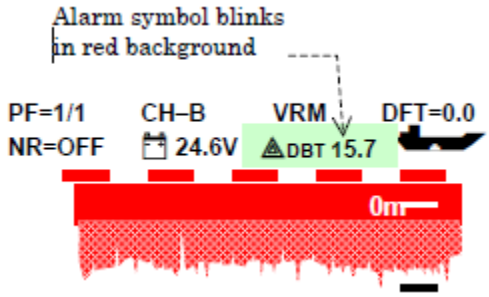


Figure 3-37 Setting Alarm Depth – Example
VRM turned on
Alarm depth at 15.7m DBT*
PF=1/1 CH–B VRM DFT=0.0
NR=OFF 24.3V DBT15.7
• Turn on the Variable Range Marker (VRM)** by pressing SET ALARM.
VRM placed at 15.7m
• Repeatedly press / to place VRM at the desired alarm depth.
10m
15.7
20m
• Press ENT MARK. This places the alarm depth at the VRM position.
30m
* DBT=depth below transducer
** VRM is a horizontal dotted line with depth indication to the right of its center, as in the example below. To turn it off, press SET ALARM again.

1.3.12.2.2. Depth Alarm Indications

As soon as the current depth decreases beyond the preset depth, the alarm will be triggered with the following audible and visual indications.
 Audible: Beeps at approximately 1 second intervals. The sound can be muted by pressing CLR DEPTH ALARM.

 Visual: Blinks alarm symbol together with on–screen preset value on red background at approximately 1 second intervals.
Figure 3-38 Visual Indication of Depth Alarm Being Triggered – Example



1.3.12.3. Missing–Bottom Alarm

This alarm will be triggered when one of the following situations occurs and continues for 4 seconds or more, making it impossible for the equipment to register depth reliably:

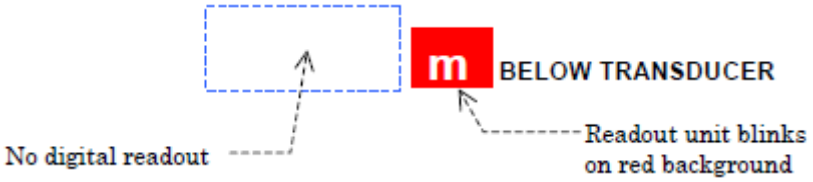
- no bottom echo is received.
- the bottom echo has become too weak, showing in weaker colors*.
- the bottom echo has exceeded the present depth range limit.

* yellow, green, blue, etc. or user–defined colors except two strongest ones

The alarm condition will be indicated audibly and visually, as follows:

- Audible: Beeps at approximately 1 second intervals. The sound can be muted by pressing CLR DEPTH ALARM.
- Visual: Blinks depth readout unit (m, FM, BR or FT) on red background at approximately 1 second intervals without a depth value.

Figure 3-39 Visual Indication of Missing–Bottom Alarm



To remedy the alarm condition, increase the receiver gain or select a greater depth range. If the problem persists, suspect that the transducer in use is disconnected or has become defective.

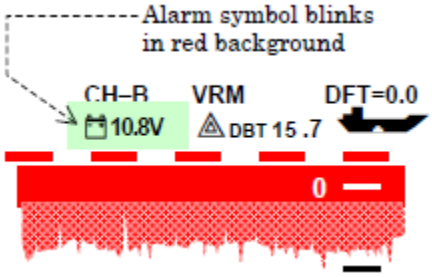
1.3.12.4. Power Failure Alarm

If, for any reason, the voltage of the power source drops below the specified level during DC–powered operation, the power failure alarm will be triggered with the following audible and visual indications.

- Audible: Beeps at approximately 1 second intervals. The sound can be muted by pressing CLR DEPTH ALARM.

 Visual: Blinks alarm symbol and on–screen voltage readout (DC–powered operation) on red background at approximately 1 second intervals.

Figure 3-40 Visual Indication of Power Failure Alarm Being Triggered – Example



NOTE: The power failure alarm is not available when the equipment operates off an AC power source. The equipment is designed to work normally over a wide voltage range (typically from approx. 80 to 240 volts a–c), eliminating the need for an alarm to alert the user to low voltage conditions. In the event of power outage, a power removal alarm will be triggered. See paragraph 3.12.5 below for details.

1.3.12.5. Power Removal/Shutoff Alarm

In the event that power is removed or shut off at the source (due, for instance, to accidental unplugging of power cable or to power outage) with the equipment in normal operation, an audible alarm will sound for several minutes to warn the operator of the power line trouble.

To silence this alarm, press the rear panel button* marked “POWER ALARM .”

Figure 3-41 Mute Button for Power Removal Alarm

NOTE: Since no power is fed to the equipment under such conditions, the echogram screen is turned off and a visual alarm indication is not available.

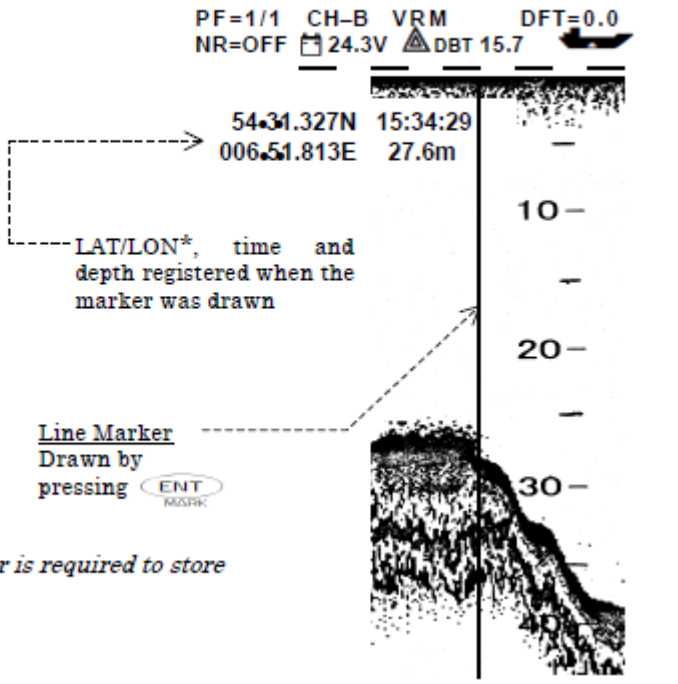
* Later serial number version units have an additional alarm reset switch behind the hinged front lid. See paragraph 9.3.8 for related information.

3.13. Line Marker

Pressing ENT during normal echo sounder operation will cause a red line to be drawn vertically across the screen at the current sounding position (i.e. extreme right edge of the active screen area), along with the current depth readout and time (and LAT/LON coordinates, if an optional GPS sensor is plugged into the rear panel I/O DATA connector). The marker will remain on–screen for approximately 20 minutes

before it is scrolled to the left off the screen.

Figure 3-42 Drawing a Line Marker – Example


PF=1/1 CH–B VRM DFT=0.0
NR=OFF 24.3V DBT 15.7
54•31.327N 15:34:29
006•51.813E 27.6m
10
20
30
LAT/LON*, time and depth registered when the marker was drawn
Line Marker
Drawn by pressing ENT MARK
* An optional GPS sensor is required to store the position coordinates.

Storing/Recalling Graphics Data

Pressing ENT MARK also initiates the function of storing into memory the right half of the current echogram. The stored graphics data will be recalled onto the left half screen by pressing MODE . A second keypress turns the memory display off. The stored data will be erased from memory once the equipment is turned off. See paragraph 3.5 for details.

Hard Copy of Echogram

Stored echogram can be printed out with a suitable graphics printer** plugged into the rear panel "PRINTER" connector. A pop–up menu should be displayed for a few seconds over the recalled echogram when MODE is pressed. Select option "START" to initiate the printing action. See paragraph 3.6 for details.

** DOS/V–compatible printer with ESC/P control protocol

1.4 Maintenance

User–Level Maintenance Instructions

To ensure long–term trouble–free operation, the user should regularly follow the maintenance instructions described in this section.

Maintenance on the Equipment Cabinet

Keep the equipment away from sea splashes, direct sunlight and other heat-generating sources, and make sure that air around the cabinet is circulating freely. If the equipment is not going to be used for prolonged periods of time, dismount it from the

vessel and place it in dry storage. Be sure to switch the equipment off before removing electrical connections from the rear panel.

< WARNINGS >

1. EXTREMELY HIGH VOLTAGES EXIST INSIDE THE CABINET. THE USER MUST NOT OPEN THE CABINET.
2. CHEMICAL SOLVENTS, SUCH AS PAINT THINNERS AND BENZENES, MUST NOT BE USED TO CLEAN THE CABINET OR SCREEN FILTER, OR PERMANENT DAMAGE TO THOSE PARTS WILL RESULT.

To clean the cabinet surface, a neutral type household detergent intended for office equipment is recommended.
Cleaning the acrylic filter on the LCD screen should be a maintenance routine to avoid using a high brightness level. To clean the screen filter, use a piece of slightly wet cloth. If stains persist, the cloth may be moistened with a neutral type detergent.

Maintenance on Electrical Connections

The high humidity marine environment can cause electrical contacts in the rear panel connectors to corrode over time. Vibrations and shocks normally encountered on the vessel in motion can cause the electrical contacts to become loosened. Corroded or loose contacts will become responsible for erratic, intermittent operation or poor performance. To avoid such possible problems, conduct the following maintenance operations at least once a year:

 Unplug all the cables from the rear panel, and check to be sure that contact surfaces,
including the pins in the rear-panel mounted receptacles are free from corrosion.
 Check the connections at the ship's power source for freedom from any sort of corrosion.
 Correct any problem using a high quality contact–cleaning agent (contact rejuvenator).

< WARNINGS >

1. BE SURE TO TURN THE EQUIPMENT OFF BEFORE REMOVING /INSTALLING THE CONNECTIONS FROM / TO THE REAR PANEL CONNECTORS.
2. SANDPAPER WILL DAMAGE THE CONTACT SURFACE AND MUST NOT BE USED.

Maintenance on The Transducers

Marine growth on the transducer face will cause the sensitivity (ability to detect weak echoes) to drop over time. Whenever there is an opportunity to access the installed transducers, check for any growth of barnacles or weed on the face. Carefully remove such growth using a piece of wood or sandpaper, taking care not to score the face material.

< CAUTION >

Painting the transducer face will degrade the sensitivity.

8.4. Servicing the Equipment

If the equipment shows any sign of malfunction, contact your dealer for assistance. Dangerous high voltages are present inside the equipment cabinet. Do not open the cabinet in an attempt to correct the problem.

There are no user–serviceable parts inside.

Resetting the System

Resetting is the action of clearing all user–entered data and/or operational settings from the non–volatile (flash) memory on the internal CPU board, returning to the factory's default settings. However, the soundings data, date/time, and other information that were automatically stored in the memory intended for later review or retrieval will be protected against erasure.

If you are repeatedly experiencing difficulty getting the equipment work the way you have programmed or if, for any reason, you wish to initialize all settings to the factory defaults, execute the resetting procedure described below.

 Switch the equipment off.

 Switch it on again while holding down

until two quick beeps are heard.

The following message will be very briefly displayed at the screen's upper left corner:

CLEAR BACKUP MEMORY

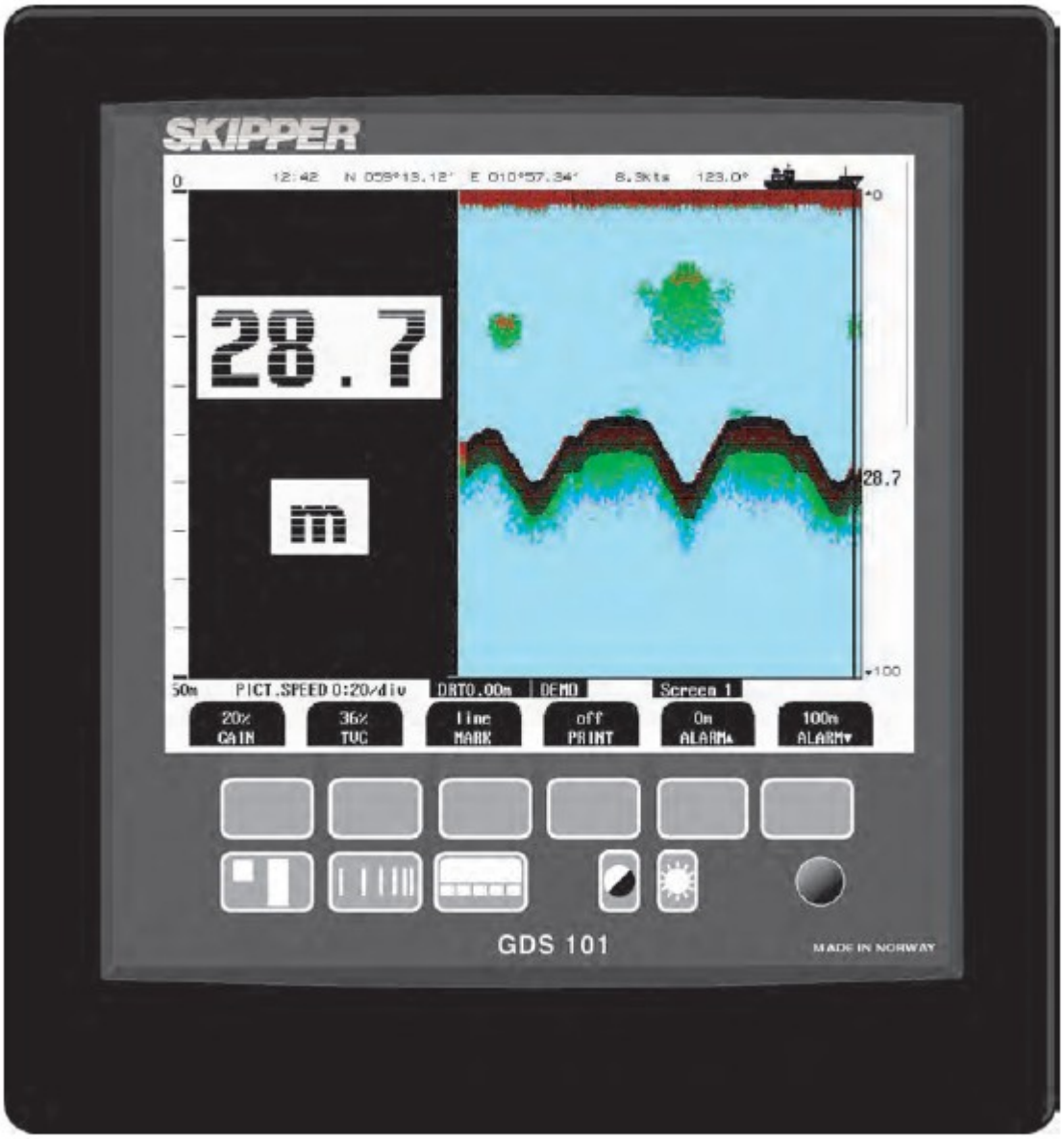
The normal operating screen will then return.

This completes the resetting procedure.

 Register the initial operating parameters, such as alarm depth, date/time, UTC offset, transducer draft, keel offset, transducer/channel assignments, location, etc., through the menu system.

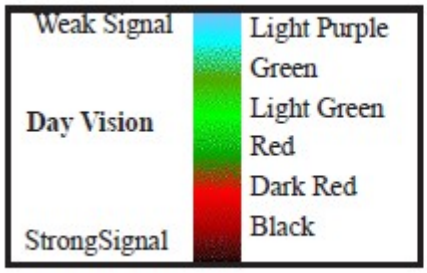
2 GDS101

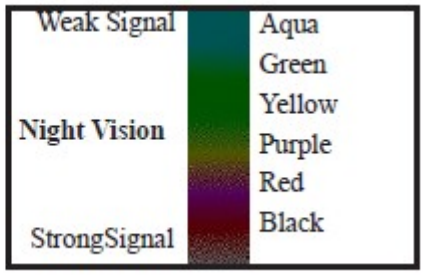
2.1 System overview



System Summary

GDS101 is a navigation echo sounder with a large high resolution graphic LCD. The echo sounder graphics are continuously shown on the LCD along with complete navigational details.
The colour bar:





It is possible to connect an external printer to the operator unit. The sounder contains a 24 hour history memory that can be printed out. Depth, time and all available navigation data are stored continuously so that the last 24 hours of information is always available. All this information may also be printed on the external printer. All IMO requirements are met or exceeded. Comprehensive interfaces are available including IEC 61162-1:2007(E) (NMEA 0183) inputs and outputs.

Transducers

GDS101 is prepared for connection to transducers of the following frequencies: 38, 50 and 200 kHz. One or more of the transducers may be connected at the same time, and the desired transducer may be selected from the operator panel.

Operator Panel and Data Entry

The operator unit contains a graphic LCD and a keyboard with fixed keys, soft keys and a rotating encoder. The function of each soft key button depends on the active screen, and the buttons are labeled on the lower rim of the LCD. The display is backlit, and contrast and backlight intensity may be adjusted by the user. The echo gram is displayed continuously on the LCD and stored in the 24 hour history memory. An optional external printer is used if hard-copy documentation is required. The operator unit is normally flush mounted. Power supply options are 115/230 V AC or 24 V DC. The power consumption is app. 70 Watt at 115/230 V AC or 50 Watt at 24 V DC. Several screens may be selected to enter various settings and calibration parameters. Each screen has a selection of soft key buttons. Screens 1 through 3 are primary operation screens with appropriate operator controls. Screens 4 through 10 are calibration setup and system supervision screens. The various screens will be described in detail later.

Recorded Data Storage

The measured depth and other navigational data is continuously stored in the 24 hour history memory. A standard printer HP Deskjet or Epson D88/LQ300 (all with Centronics parallel interface) may be connected for paper copy. Ask SKIPPER for specification.
WARNING!
False bottom echoes may occur when:

• The bottom is out of range.

• Extreme noise conditions are present.

• Bottom signal may be lost for other reasons, like wakes or aeration below transducer.

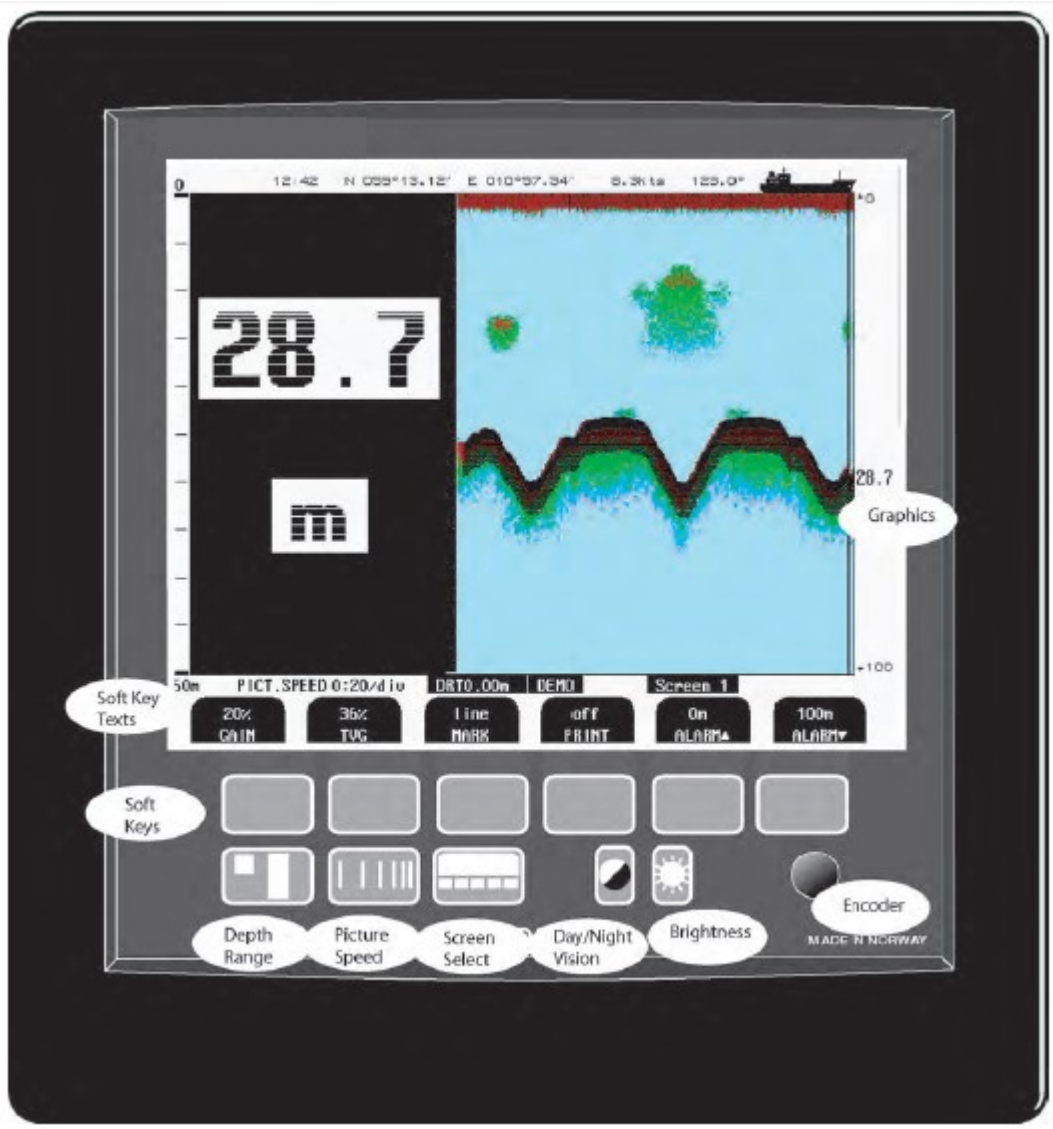


Fig. 1.1 Main Display Unit Panel Layout

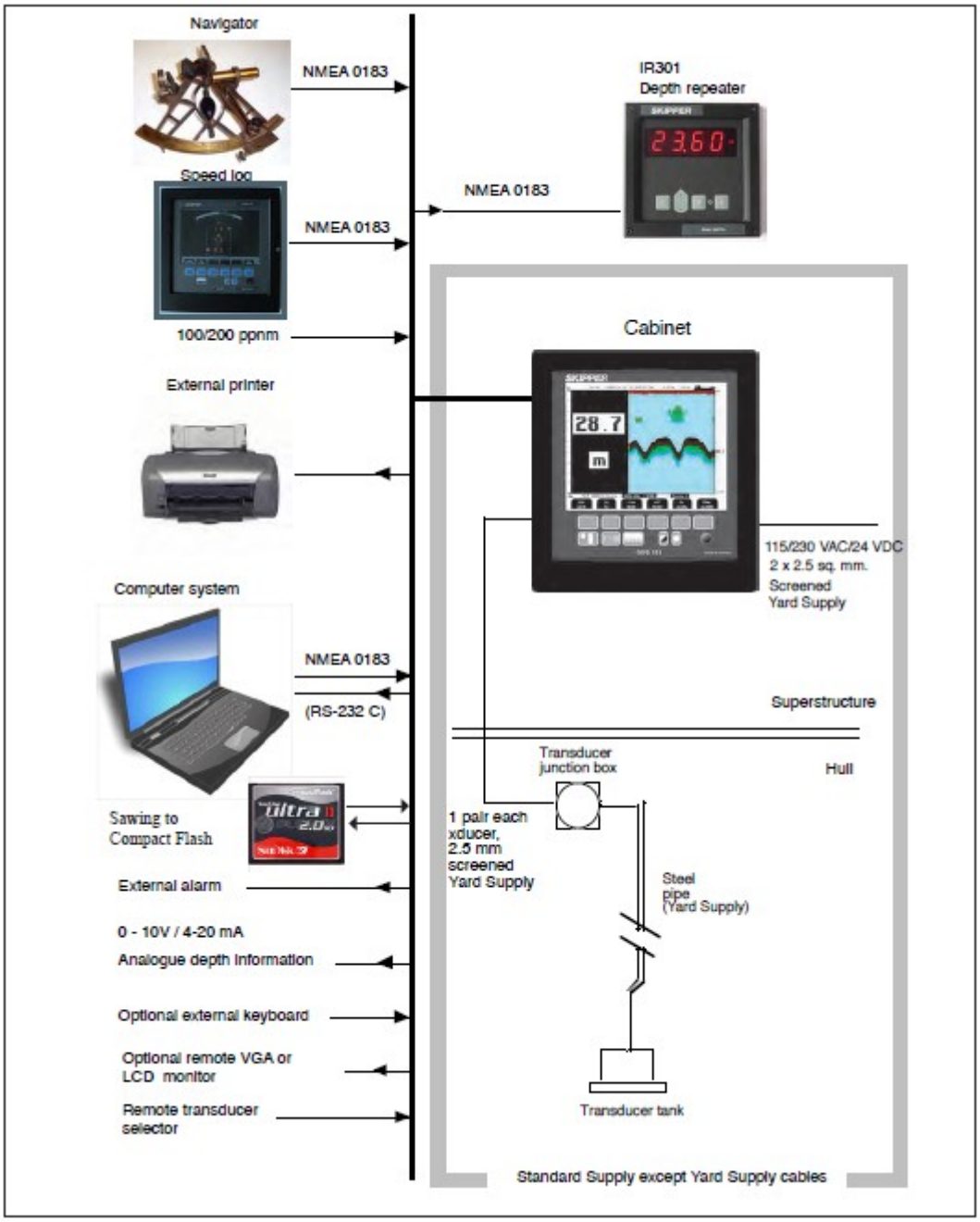


Fig. 1.2 System Diagram

Interfacing

The GDS101 has several interface possibilities.

Outputs

• Trigger and bottom pulse outputs.

• Analogue output 0 - 10 V or 4 - 20 mA.

• IEC 61162-1:2007(E) (NMEA 0183).

• External alarm relay output.

• External printer.

• External VGA monitor.

Inputs

• Log input 100/200/400/20000 pulses per nautical mile.

• IEC 61162-1:2007(E) (NMEA 0183) interface input of position, heading, speed and UTC.

• Remote control and synchronisation of transmitter. (Option).

• Remote transducer switch.

• Remote keyboard.

• Remote alarm reset.

Alarms

Shallow and deep water alarms may be selected from screen 1. A potential free relay contact is provided in GDS101 for interface to external alarm systems.

Options

Repeaters

Graphic CRT or LCD display or digital depth slave repeaters may be connected to the system. Along with the graphic display repeaters, there may also be installed a remote keyboard.

Remote Sounding Control

* This option lets the GDS101 being remote controlled in synchronized, burst or single ping modes.

Auto Range

This option will automatically adjust the depth range to maintain the bottom contour within the middle half of the screen.

Sound Speed Calibration

* This option will enable adjustment of the sound speed value used for the depth calculations.

*Note: These options can not be used with IMO approval.

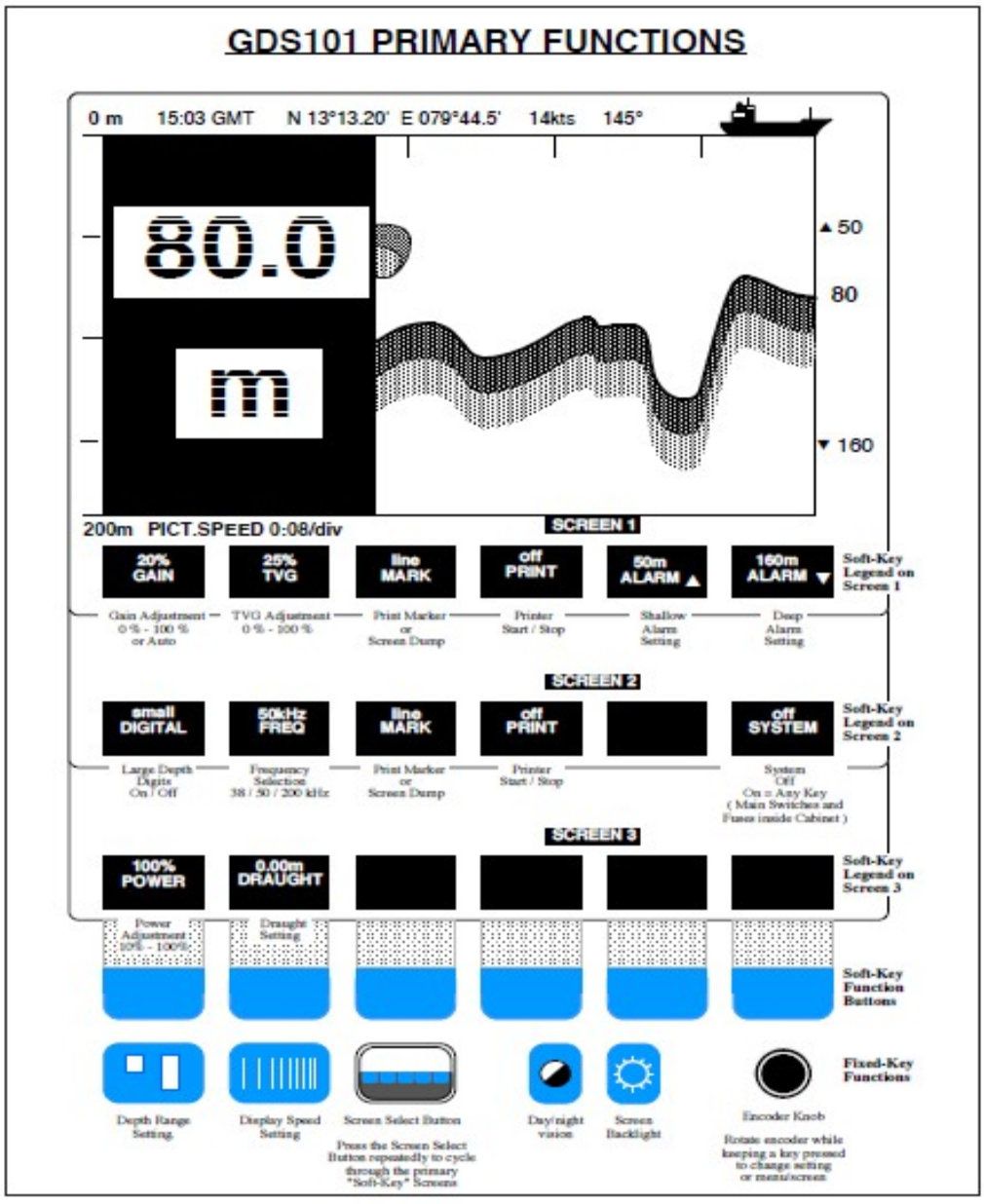


Fig 1.3 GDS101 Primary Functions

2.2 Technical data

Specifications, Dimensions

Transducer, 38 kHz	Diameter.	181 mm.
	Mounting.	Tank/sea valve /ice tank.
	Cable length.	40 m.
	Weight.	ca. 20 kg.
	Protection.	IP 68.

Transducer, 50 kHz	Diameter.	90 mm.
	Mounting.	Tank/ sea valve/ice tank/aluminium tank.
	Cable length.	25 m or 40 m.
	Weight.	ca. 7 kg.
	Protection.	IP 68.

Transducer, 200 kHz	Diameter.	140 mm.
	Mounting.	Tank/ice tank.
	Cable length.	25 m or 40 m.
	Weight.	ca. 8 kg.
	Protection.	IP 68.

Transducer, 200 kHz	Diameter.	90 mm.
	Mounting.	Tank/sea valve/ice tank/aluminium tank.
	Cable length.	25 m.
	Weight.	ca. 7 kg.
	Protection.	IP 68.

Transducer Junction Box	Size incl. glands.	132 x 111 mm.
	Depth.	55 mm.
	Weight.	0.6 kg.
	Protection.	IP 56.

Operator unit cabinet	Height, front.	340 mm.
	Width.	320 mm.
	Depth.	170 mm.
	Weight.	ca. 10 kg.
	Protection.	IP 23.

Functional Properties

Display.	10,4" 158 x 211 mm graphic LCD screen with adjustable day/night vision and backlight. 640 x 480 pixels.
Printer.	HP Deskjet, Epson D88 or Epson LQ300.
Depth alarms.	Deep and shallow limits.
Calendar/Clock.	Year-month-day/hours-minutes-seconds (24 hour system).
Interface outputs.	Trigger and bottom pulses.
	Analogue 4 - 20 mA and 0 - 10 V for depth. Detected video.
	IEC 61162-1:2007(E) (NMEA 0183) for depth.
	Alarm relay.
	Output for VGA repeater.
	RS-232 C.
	PC parallel printer port.
Interface inputs.	100/200/400/20000 pulses for speed.
	IEC 61162-1:2007(E) (NMEA 0183) for speed, position, heading and time.
	Remote alarm reset.
	Remote transducer selector.
Languages.	English, French, Spanish, Russian, German and Norwegian.
Options.	VDR (Voyage Data Recorder) or IR301 digital remote depth indicator.
	LCD repeater.
	Remote keyboard.
	Remote sounding control.
	Auto range.
	Sound speed calibration.

Performance

Depth range.	0 - 1600 m.
Graphic resolution.	0.5 % of range.
Digital screen resolution.	<10 m: 0.01 m.
	>= 10 m <100 m: 0.1 m.
	>= 100 m: 1 m.

Transducer, 24 kHz/38 kHz.	Beam angle.	16°/20° conical.
	Max. power.	1 kW.
	Effective range.	3000 m/2000 m.
Transducer, 50 kHz.	Beam angle.	33° conical.
	Max. power.	1 kW.
	Effective range.	1000 m.
Transducer, 200 kHz.	Beam angle.	6° conical.
	Max. power.	1 kW.
	Effective range.	500 m.
Transducer, 200 kHz.	Beam angle.	10° conical.
	Max power.	1 kW.
	Effective range.	300 m.

Environmental according to IEC60945:
Transducer and Junction Box

Operating temperature.	-15 - 55 degree C IEC 60945.
Storage temperature.	-20 - 70 degree C.
Protection, transducer.	6 bar, IP 68.
Protection, parts inside hull.	IP 56.

Operator Unit Cabinet

Supply voltage.	230 V (195 - 253 V AC) or 115 V (96 - 125 V AC).
	24 V DC (20 - 32 V).
Power consumption.	50 W at 24 V, 70 W at 230 V AC or 115 V AC.
Alarm relay.	Change-over contact, max. 24 V 300 mA.
RS-232 C port.	Standard 25 pin D - type connector (located on terminal PCB inside cabinet).
NMEA port.	9 pin D - type. 2 inputs, 2 outputs.
Operating temperature.	-15 - 55 degree C according to IEC 60945.
	To increase serviceability and life-time, we suggest the working temperature to be held at 0 - 40 degree C.
Storage temperature.	-20 - 70 degree C.
Humidity.	10 - 90 % relative, no condensation.
Protection.	IP 23.

2.3 Operation

When the installation is complete, and power is connected to the operator unit, the system is switched on-off by power switch(es) inside the cabinet.

Parameter entry

The fixed function and soft key buttons of the various screens along with the rotating encoder, facilitates entry of parameters, setpoints and other data. The following flowchart illustrates the procedure for changing settings and entering data. The various screens are shown in detail in the operation section.

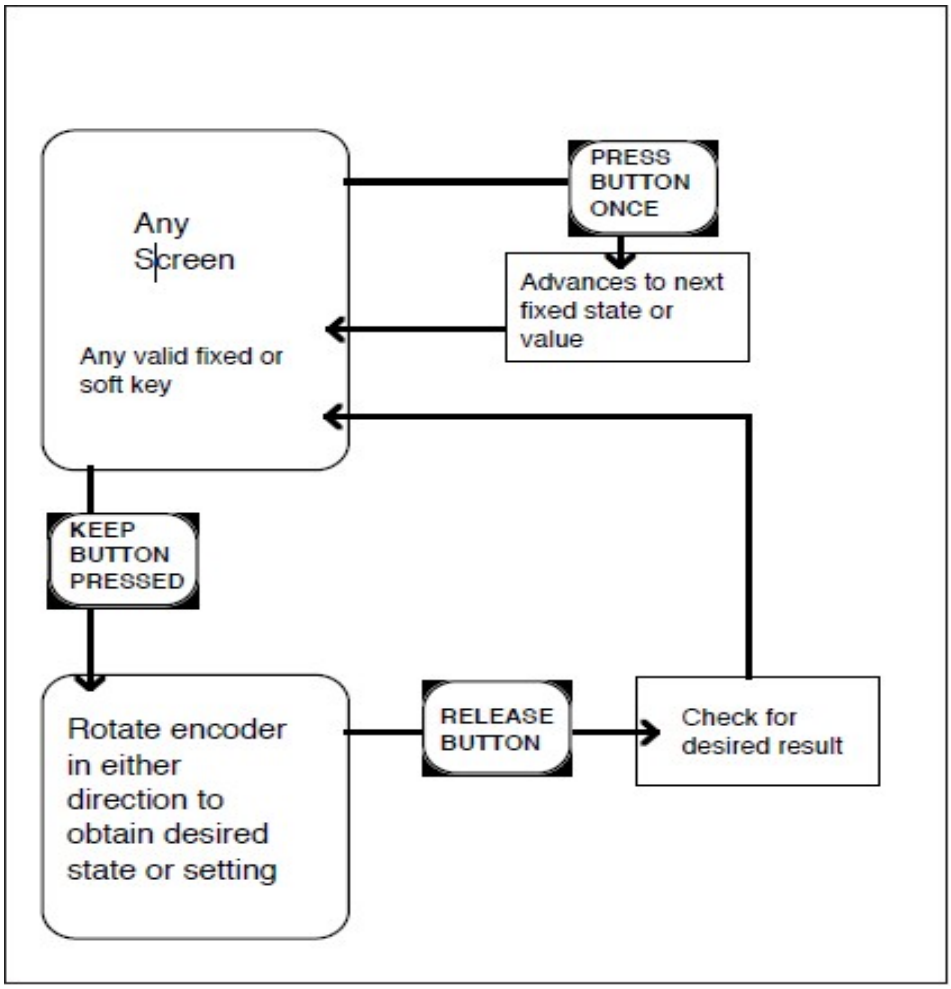


Fig. 3.1 Setting and Parameter Entry Flowchart

Example of parameter entry

Suppose you want to enter a value of 800 m for the depth range. Press the DEPTH RANGE button several times and observe the depth range sequencing through the standard values 10, 50, 100, 500, 1000 m. Press till the range is 500 m. Then press the DEPTH RANGE button again and keep it pressed while you turn the encoder clockwise. Observe the depth range increase to 800 m, release the encoder and the DEPTH RANGE button. You could also have started from the standard value 1000 m and decreased to 800 m by turning the encoder counter-clockwise.
Buttons with less than 6 possible states or values can be operated without using the encoder at all.

Operation Screens

Each of the operation screens contains a graphic picture and a selection of up to 6 soft key buttons. The various screens are selected by keeping the SCREEN SELECT button pressed and rotating the encoder in either direction. Turning the encoder clockwise cycle the screens in the sequence 1 to 10, and counter clockwise rotation cycles the screens in the sequence 10 to 1. Screens no. 1, 2 and 3, covering the primary functions, may also be cycled by repeatedly pressing the SCREEN SELECT

button.

The screen layouts are outlined in fig. 2.2 through 2.11. The various soft key functions are described with each screen.

Primary Operation Screens

Fig. 3.2. Screen 1, Primary Operation screen.

This screen shows the main graphic echo gram. Left hand digital indication may be enabled from screen 2.

Soft key	Name	Range/value	Default value	Description
1	GAIN	0 - 100 %	20%	Gain adjustment. (100 % is max. gain).
2	TVG	0 - 100 %	36%	Time Variable Gain adjustment. (0 % is max suppression).
3	MARK	Line		Print mark line/print screen.
4	PRINT	On/off	Off	Start and stop of continuous printing. (If printer is switched off or not connected, this button is “Dimmed”).
5	ALARM ▲	0 - 100 m	0 m	Shallow water alarm adjustment.
6	ALARM ▼	0 - 1600 m	100 m	Deep water alarm adjustment.

The currently selected transducer (frequency) is indicated at the bottom of all screens along with optional transducer position, e.g. 200 kHz/FWD. (DRT0.00 m and 200 kHz/FWD are toggling with 1 sec. interval.) Selection of the transducer position

reference is performed in screen 10.

Fig. 3.3. Screen 2, 2nd Operation screen.

Soft key	Name	Range/value	Default value	Description
1	DIGITAL	Off, small, large	Off	Control of digital depth indication.
2	FREQUENCY	38*/50/200 kHz	50 kHz	Transducer selection. (Have to be “installed “ in screen 10,
3	MARK	Line		Print mark line/dump screen.
4	PRINT	On/off	Off	Start and stop of continuous printing.
5				Not used.
6	SYSTEM	On/off	on	Switch system off. Switch on with any button. (NOTE:There is still power on the GDS101).

* Note: 38 kHz may vary if other options are installed.

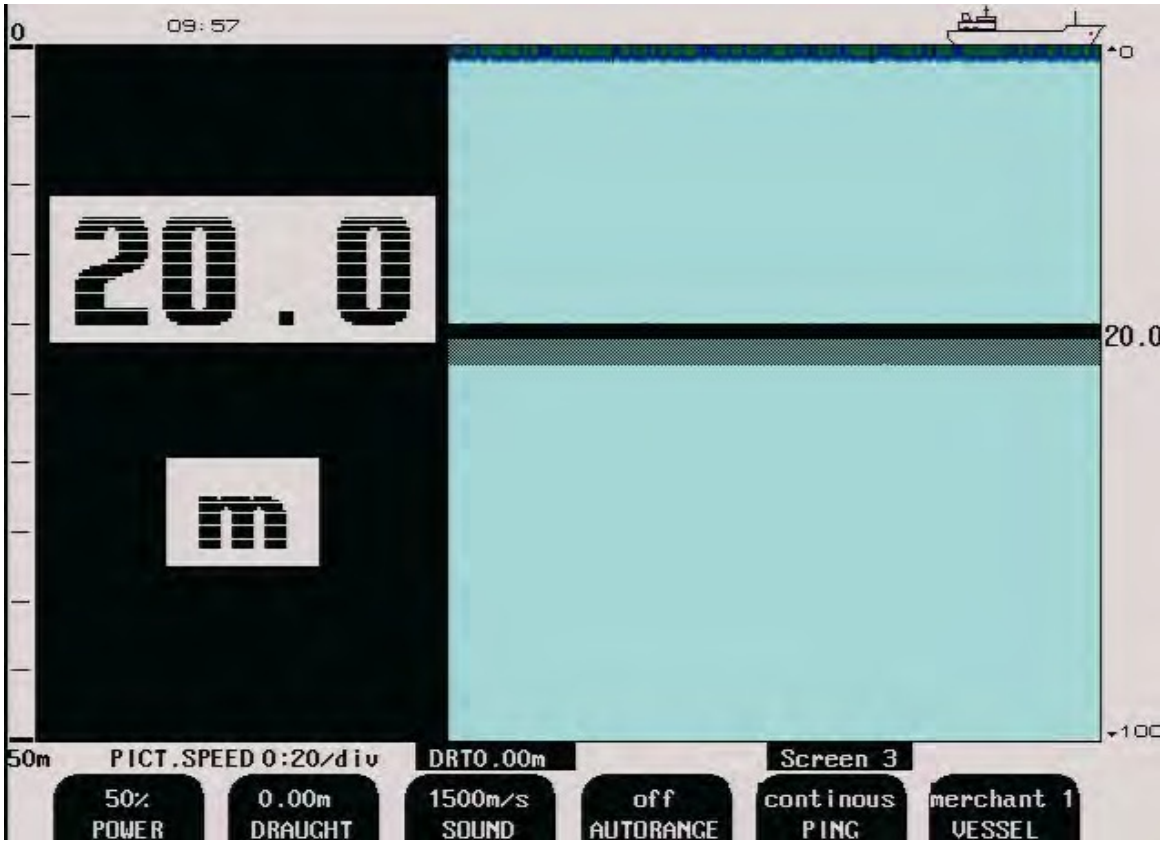


Fig. 3.4. Screen 3, 3rd Operation screen.

Soft key	Name	Range/value	Default value	Description
1	POWER	1 - 100 %	50%	Transmitter power adjustment
2	DRAUGHT	-99.99 - 99.9 m	0.00 m	Draught correction, must be set individually for each frequency.
3	SOUND	1400 - 1550 m/s	1500 m/s	Sound speed setting, (option).
4	AUTORANGE	On/off	Off	Auto range control, (option).
5	PING	Continuous, edge, level, single	Continuous	Ping control, (option).
6	VESSEL	Merchant 1/2, Navy 1/2	Merchant 1	Upper right screen icon selection, (option).

Note: Soft keys 3, 4 and 5 controls optional functions.
Note: If options are installed, it is also possible here on screen 3 to select vessel icon (soft key 6).
Secondary Operation Screens

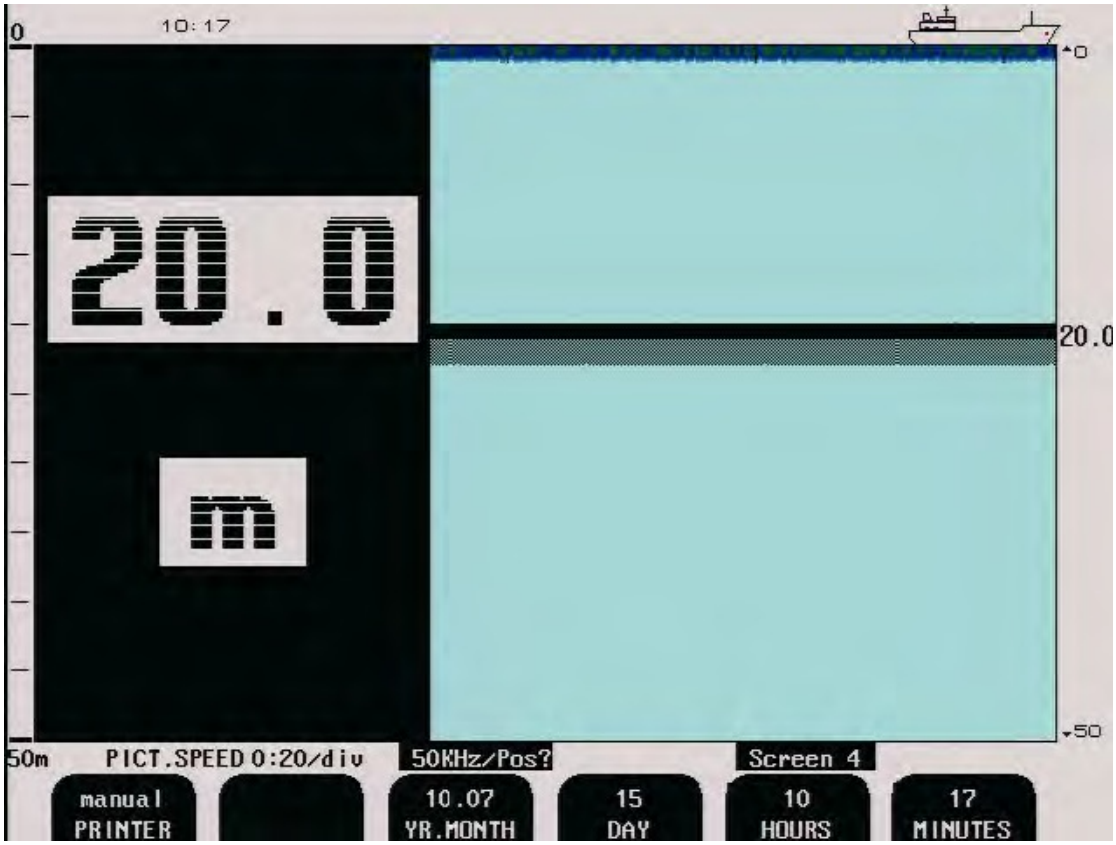


Fig. 3.5. Screen 4, Calendar and clock setting.

Soft key	Name	Range/value	Default value	Description
1	PRINTER	Manual/auto	Manual	External printer start options. Auto: Printer start, if depth alarm is activated.
2				Not used.
3	Y(EA)R.MONTH	01.03 ->		Calendar year setting
4	DAY	1-31		Calendar day setting.
5	HOURS	0 - 23		Real time clock hours setting.
6	MINUTES	0 - 59		Real time clock minutes setting.

Note: If GPS is connected, soft key 3, 4, 5 and 6 are controlled by GPS.

Fig. 3.6. Screen 5, Language and units of measure setup.

This screen shows the main graphic echo gram. Left hand digital indication may be enabled from screen 2.

Soft key	Name	Range/value	Default value	Description
1	SET LOW	24, 28, 30, 33, 38 kHz		Adjust indicated frequency of lower frequency channel. (See chapter 5, low frequency indication).
2	LANGUAGE	English ,French, Spanish, Russian ,German, Norwegian	English	Screen language selection
3	DEPTH	Meters, feet, fathoms, braccias	Meters	Unit of measurement for depth.
4	PICT.SPEED	Min:sec	Min:sec	Unit of measurement for picture speed.
5	VESSEL SPD	Knots, km/h, mi/h	Knots	Unit of measurement for vessel speed.
6	SOUND SPD	m/sec, ft/sec	m/sec	Unit of measurement for sound speed.

Note: If a speed log is connected, it is possible to select different “PICT.SPEED” units.

Fig. 3.7. Screen 6, Interface setup screen.

This screen shows the main graphic echo gram. Left hand digital indication may be enabled from screen 2.

Soft key	Name	Range/value	Default value	Description
1	PULSE	100/200/400/20000	100/NM	Speed log input pulse rate.
2	ENABLE(option)	Positive/negative	Positive	Select polarity of external sync signal (remote sounding control option).
3	NMEA OUT	async (1s)/(sync)hronous	async (1s)	Select between synchronous (with sampling rate) and asynchronous (1s period) NMEA output update.
4				Not used
5	UPPER	0 - 199 m	0 m	Analogue output shallow water limit = 0 V (4 mA).

6	LOWER	0 - 200 m	50 m	Analogue output deep water limit = 10 V (20 mA).

Note: Soft key 2 controls optional function

Fig. 3.8. Screen 7, History Memory Control Screen.

This screen shows the main graphic echo gram. Left hand digital indication may be enabled from screen 2.

Soft key	Name	Range/value	Default value	Description
1	HISTORY	On/off	On	Start/stop (keep) history recording
2	HISTORY	Recording/playback	Recording	Record/playback of history.
3	HIST. HOUR	-23 - 0 hour		History playback spooling, hours.
4	HIST. MIN	-59 - 0 min		History playback spooling, minutes
5	MARK	Line		Print mark line/dump screen.
6	PRINT	(Not ready)/On/off	Off	Start and stop of continuous printing

Fig. 3.9. Screen 8, NMEA control screen.

This screen shows list of received or transmitted NMEA messages and half screen echo gram

Soft key	Name	Range/value	Default value	Description
1	SCREEN	Print		Print screen.
2	BAUD	4800/9600	480000%	NMEA baud rate selection
3	IN/OUT	COM 1/COM 2	COM 1	I/O port selection
4	MESSAGE	DPT, DBS, DBT,DBK, PKSKP,CHECK SUM,EN250, EN250 D#,XDR	DPT: On DBS: Off DBT: Off DBK: Off PKSKP: Off CHECK SUM: On EN250: Off EN250 D#: Off XDR: Off	Select if message should be on/off by soft key 5.CHECKSUM, select if PSKPDPT should contain checksum or not by soft key 5.
5	STATUS	On/off		Select if MESSAGE should have on or off status.

6	DISPLAY	Off/input/output	Input	Selects what kind of information to be displayed.Off: None.Input: Received NMEA messages.Output: Transmitted NMEA messages.

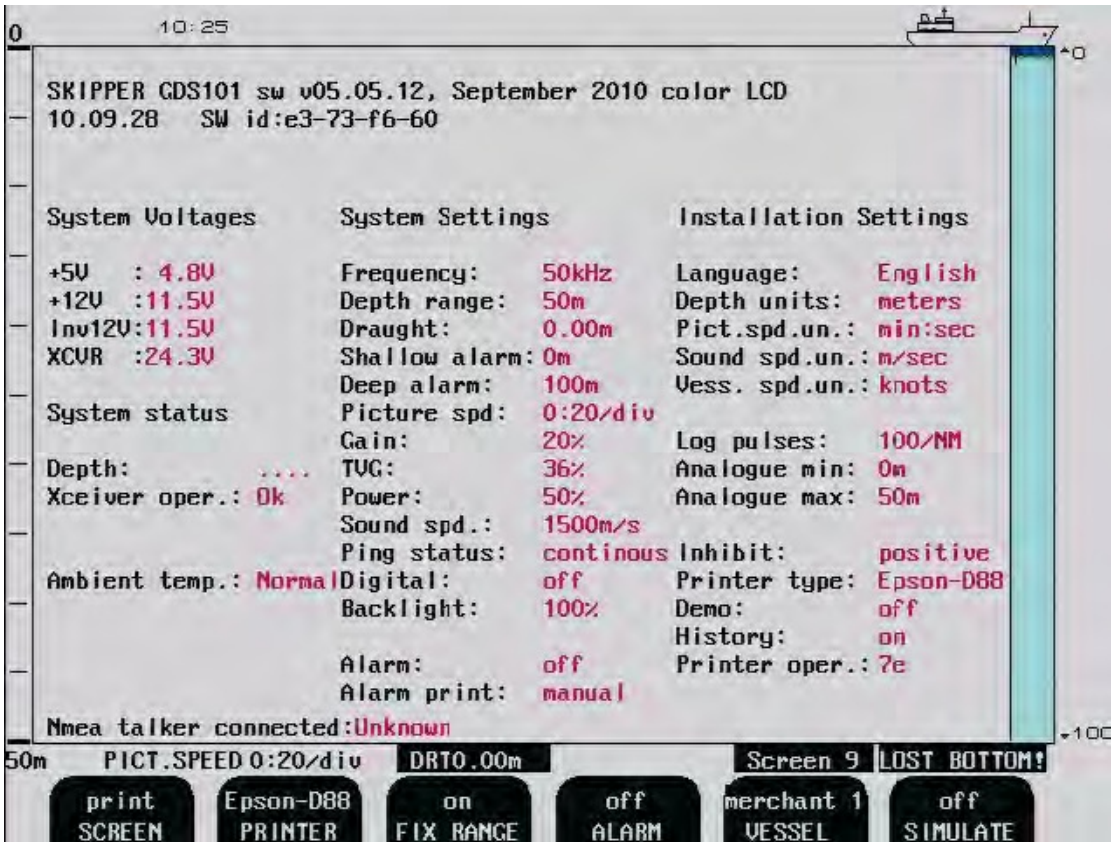


Fig. 3.10. Screen 9, System status screen.

This screen shows a comprehensive list of system settings and parameters

Soft key	Name	Range/value	Default value	Description
1	SCREEN	Print		Print screen.
2	PRINTER	HP DeskJet/Epson (LQ300+)/Epson-D88/Built-in printer.	Epson-D88	Select type of printer that is connected.
3	FIX RANGE	On/off	On	Limit search range to window. FIX RANGE “on”gives better detection in case of noisy signal.
4	ALARM	On/off	Off	Internal alarm buzzer control.
5	VESSEL	Merchant 1/2, Navy 1/2	Merchant 1	Upper right screen icon selection.

6	SIMULATE	On/off	Off	Built-in simulator control.

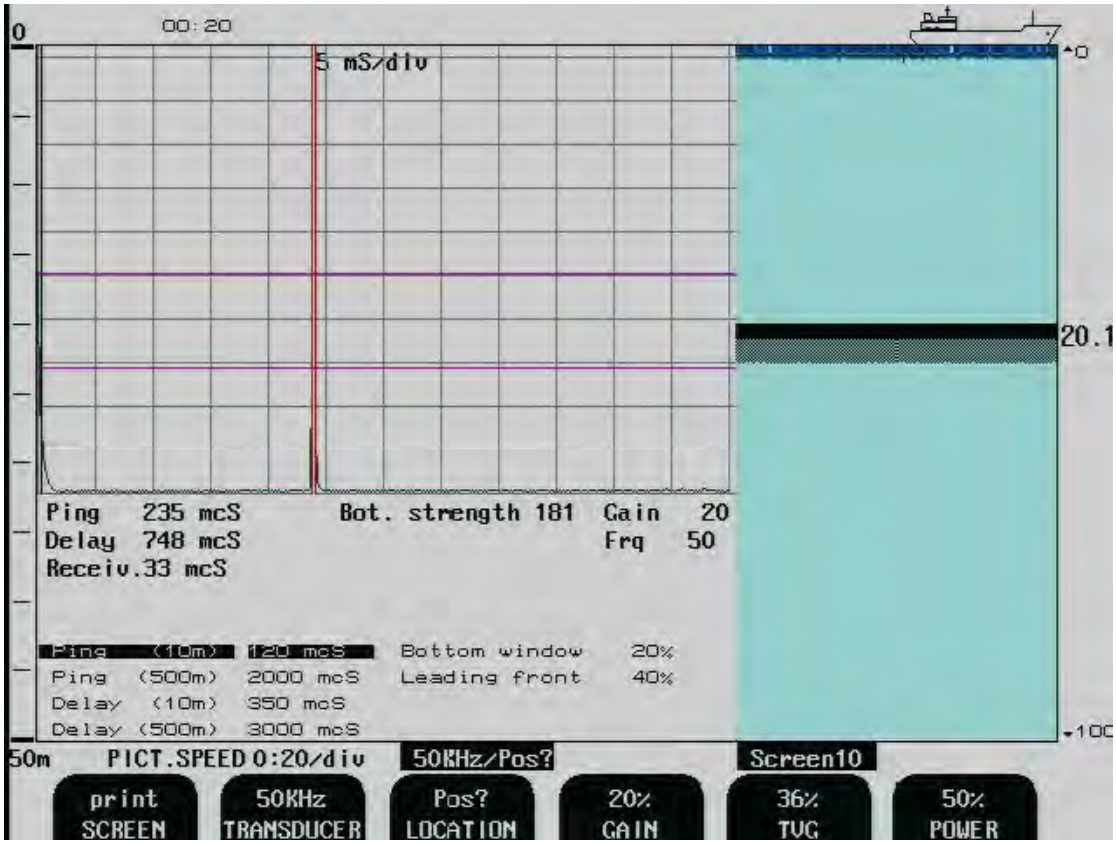


Fig. 3.11. Screen 10, Oscilloscope screen.

This screen shows receiver output versus time and half screen echo-gram.

Soft key	Name	Range/value	Default value	Description
1	SCREEN	Print		Print screen.
2	TRANSDUCER	38, 50, 200 kHz	50 kHz	Transducer selection for soft key 3.
3	LOCATION	Pos?Not installed,FWD, AFT,PORT, STRB,FWD/AFT, PORT/STRB,	Pos?	If “not installed” is selected for one of the frequencies, it will not be available in screen 2, soft key 2. 2 transducers with transducer selector (ENS518). See chapter 5, remote transducer selector and NMEA sentences.
4	GAIN	0 - 100 %	20 %	Gain adjustment.

5	TVG	0 - 100 %	36%	Time Variable Gain adjustment.
6	POWER	1 - 100 %	50%	Transmitter power adjustment.

Principal Functions

Bottom detection

GDS101 employ a bottom detection algorithm that will try to extract the bottom signal from all kinds of noise and secondary echoes. When GDS101 is tracking the bottom normally, a thick black line is shown, and below that, a ribbon with a hatched pattern. This pattern has two levels of hatching. The darkest represent strong and unambiguous bottom echoes. The lighter hatching represents weaker signals possibly occasional detection misses. If the software can detect no bottom for several pings, the hatched ribbon disappears.

During normal bottom tracking, a digital value is shown by the bottom contour at the right side of the screen. If the software algorithm looses track of the bottom altogether, a warning beep is heard and the black line and hatching band disappears. A warning message: “Lost bottom” is shown in the screen’s lower right corner.

Ping to Ping filtering

Part of the bottom detection algorithm is the ping to ping filtering. The next bottom is searched for in a time and strength window based on the strength and timing of the previous bottom echoes. This procedure reduces the probability of tracking schools of fish or secondary echoes as bottom. If no bottom is detected in the calculated window, the window is gradually increased in size until the full time and strength window is used.

Bottom Search Range

The FIX RANGE function in screen 9 is used to control the search range for the bottom detection algorithm. When this function is on, bottom is only searched for within the selected display range. When the function is off, bottom is searched for within the entire functional range of the echo sounder.

System (Power) On/Off

During normal daily operation, the system may be switched off from screen 2. This operation does not disconnect the system from the power supply, but all power consuming components are switched off. The system may be switched on again by pressing any button.

Note:

Do not run the sounder for a long time without a submerged transducer connected.

Alarm acknowledgement

When the water depth alarm is activated, the alarm may be acknowledged by pressing any button.

Fixed Key Functions

Depth Range

The DEPTH RANGE button can be used to set the depth limit between 10 and 1600 m. Standard values available by repeatedly pressing the button are 10, 50, 100, 500 and 1000 m.

Picture Speed

Picture speed may be referred to either time or vessel speed. If no speed log is connected, picture speed will always be referred to time, ("min:sec/div"). Time referenced picture speed may be selected between 20 seconds per division and 5 minutes per division. Vessel speed referenced picture speed may be selected between 0.04 and 5 nm per division. If a speed log is connected, it is possible to select different "PICT.SPEED" units in screen 5. The ping-rate range depends on the depth range, and the fastest ping rate at shallow depths is about 5 pings per second.

Screen Select

The SCREEN SELECT button facilitates selection of one of the 10 screen and soft key layouts. The 3 primary operation screens may be cycled by repeatedly pressing the SCREEN SELECT button. Access to the remaining screens is through encoder operation. The screens are cycled in an endless, bidirectional loop, e.g. turning the encoder counter-clockwise, will activate screen 10 after screen 1. Turning the encoder with no buttons pressed always force screen 1.

Day/Night and back light adjustment

Day/Night vision may be selected by pressing this button. These two modes differs by colour presentation, which are optimized for different ambient light conditions.

Soft Key Functions

Gain

The received signal gain may be adjusted from 0 to 100 % to allow for optimal echo levels from bottom and other objects. The gain setting affects signals from all depths.

TVG

Time Variable Gain may be adjusted from 0 to 100 % to allow for detailed echo control from the 0 - 50 m depth range. A low setting will reduce the gain in the area near the surface to suppress noise and unwanted echoes from this area.

Digital indication

On the operation screens, two sizes of large digital depth indicators may be selected from screen 2.

1. "Small" digits.
2. "Large" digits.

Frequency

The frequency selector toggles among 38*, 50 and 200 kHz.

* Some units may have been adjusted to other frequencies.

Output Power

Power may be adjusted from 1 to 100 % in case of difficult shallow water conditions. Too high power in such cases will possibly saturate the receiver or cause detection of unwanted secondary bottom or surface echoes.

Draught

Draught may be compensated to allow real depth from surface to be shown on the screen and printout. Negative draught values may be entered to compensate for transducers fitted above the keel. This setting also affects the NMEA transmitted values. Draught value is indicated on the lower part of the screen by a flashing/alternating number.

External Printer Operation

The optional external printer is started and stopped by the PRINT button in screen 1. The printer may be used for continuous printing over a period of time or the current screen contents may be dumped to the printer for reference if something interesting is observed.

• The PRINT button switches continuous printing on and off.

• The MARK button(s) will write a line mark on the paper if it is pressed whenever the printer is running.

• If the MARK button is pressed when the printer is online, this will initiate a screen dump of the present screen contents. If printer is switched off, or not connected, the PRINT button is “dimmed”.

GDS101 Operation and Installation SKIPPER Electronics AS Page 25 of 62 Version: 20101007 Sw 05.05.12

Alarm Settings

Water depth alarm settings are performed from screen 1. Alarm limits are referred to the indicated depth. The local alarm buzzer may be disabled from screen 9, but the external alarm relay will always operate. The only way to disable the alarms completely, is to reduce the shallow water alarm to zero depth and increase the deep water alarm to maximum range. An active shallow water alarm limit must be less than an active deep water alarm limit. Alarm limits are enforced with hysteresis. A depth alarm may automatically start the optional printer, if this function is enabled on screen 4.

Clock and Calendar Settings

Manual clock and calendar adjustments are carried out in screen 4. If a satellite navigator giving UTC messages is connected to the NMEA input, the clock and calendar will be automatically updated and manual adjustment is not required.

History Memory

GDS101 has a 24 hour history memory. Depth, time and all available navigation data are stored continuously, so that the last 24 hours of information is always available. The history memory is controlled from screen 7.

The normal history modes are “on” and “recording”. New depth information is continuously stored in the memory while the oldest samples are discarded. Only bottom information is stored along with time and whatever navigational information is available in the GDS101 (position, speed, heading).

By switching HISTORY off, the stored 24 hours will be kept in the memory and no new samples will be recorded. As a warning that the memory is not recording, “HISTORY off” is flashing at the bottom of the screen.

History modes “on” and “playback” will start playing the contents of the history memory on the screen and on the optional printer, if it is running. As a warning that the displayed bottom contour is from the memory and not real time, “HISTORY” is flashing at the bottom of the screen.

The HIST HOURS and HIST MINUTES buttons used with the encoder, will enable positioning within the 24 hour memory to observe the desired part of the time frame during playback.

Simulator
The GDS101 contains a built in simulator to test the screen and various interface signals. The simulator may be switched on and off on screen 9. When the simulator is operating, “DEMO” is flashing at the bottom of the screen.
Status Screen
The status screen, screen 9 shows a list of various system parameters useful for documenting system setup and operating status. The contents of this screen will be valuable information in situations where manufacturer support is required.
Oscilloscope Screen
The oscilloscope screen, screen10 is useful when monitoring transceiver performance. The oscillogram shows the signal returned from the transceiver plotted against time and will enable service personnel to evaluate system performance and facilitate any troubleshooting.
Nonvolatile Parameter Memory
The system contains internal flash memory to maintain installation and user parameters like language and unit of measurement selection, contrast and backlight settings, etc. These parameters are automatically restored on power up. If the user parameters have never been set, default values are used.
Options
Repeaters/Slaves
Graphic display or digital depth slave repeaters may be connected to the system. Along with the graphic display repeaters, there may also be installed a remote keyboard.
Remote Sounding Control
This option lets the GDS101 being controlled remotely in synchronized (edge), burst (level) or single ping modes. If installed, this option is accessible on screen 3. (Note: Non Wheelmark model).
Auto Range
This option will automatically adjust the depth range to maintain the bottom contour within the middle part of the screen height. If installed, this option is accessible on screen 3. When the optional printer is started, auto range is automatically disabled, and the present depth range is selected as fixed.
Sound speed calibration
This option will enable adjustment of the sound speed value used for the depth calculations. The standard value is 1500 m/s, but the user may set values from 1400 to 1550 m/s to accommodate accurate propagation speed in known water conditions. If installed, this option is accessible on screen 3. (Note: Non Wheelmark model).
External Printer
Printer for endless paper or inkjet printer for single sheets (ask SKIPPER for actual type) may be connected for hardcopy requirements.

2.4 Maintenance

Transducer Maintenance

The transducers are virtually maintenance free, but occasional cleaning may be necessary depending on sea water conditions.

Operator Unit Maintenance

The operator unit contains no user serviceable parts, and requires no maintenance apart from occasional cleaning of the front panel. Please use a soft cloth and no chemicals except cleaning alcohol.

Note: In normal useage, the system should show satisfactory results with the following settings:

• Gain = 20 % (Not auto).

• TVG = 36 %.

Always try to return to these settings before continuing.

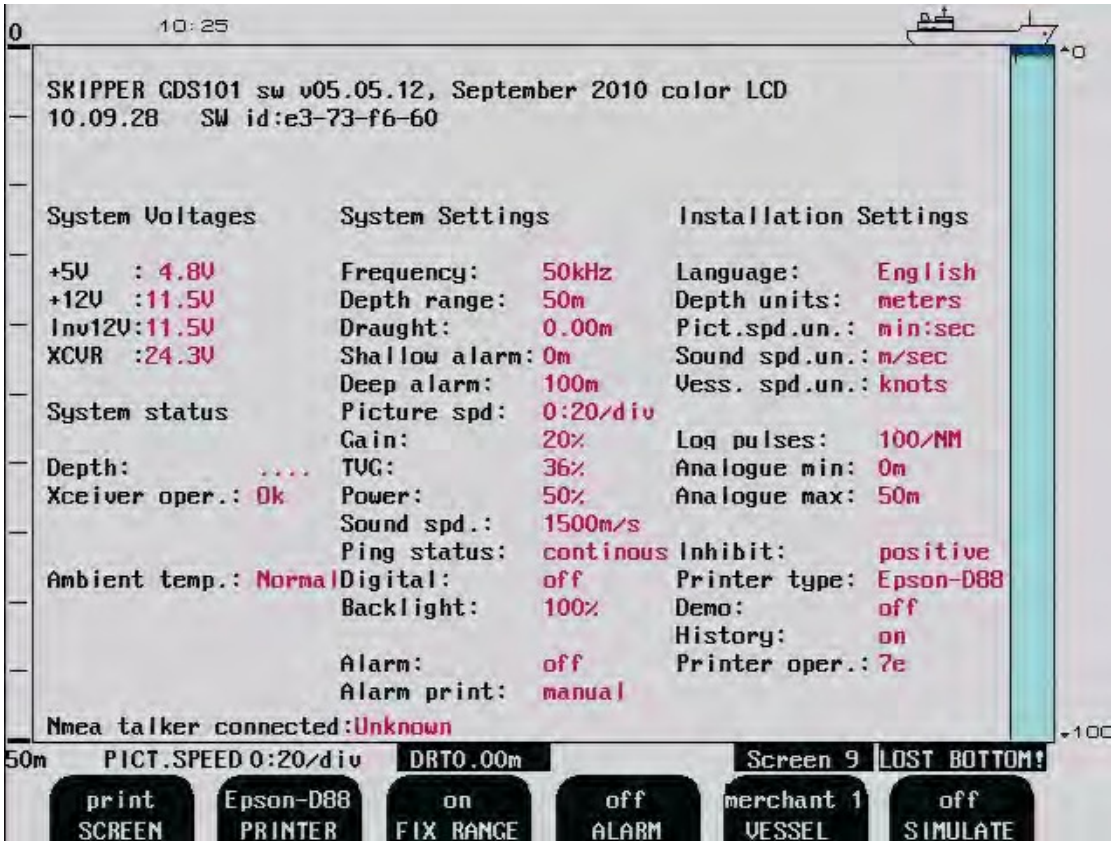
Please also try a “Master Reset”, see chapter 8 for more detalis.

Trouble Shooting

Symptom	Cause	Remedy
Basic System Integrity		
• No picture on LCD screen.	1. No AC or DC power to the system.2. System is in standby.3. Too low screen backlight.4. Defective LCD module or interface.5. Voltage(s) out of range.6. System rebooted too quickly.	1. Check switches and fuses on the terminal board inside the GDS101 cabinet. 2. Press any button on panel. 3. Increase backlight setting,change to day vision. 4. Replace module or backlight inverter PCB. 5. Replace terminal PCB. 6. Turn off powerswitch(es) - wait a few sec, restart.
• Picture is difficult to read.	1. Backlight is too weak;2. Night vision is on during day time.	1. Increase backlight setting. 2. Increase backlight setting, or change to day vision.
• Display backlight malfunctions.Display picture is hardly visible.	1. Defective backlight tubes. 2. Defective backlight inverter	1. Replace tube assembly. 2. Replace keyboard PCB. 3. Replace backlight inverter PCB.

• Rotary encoder malfunctions.	1. Defective encoder or interface. 2. Cabling error.	1. Replace keyboard PCB or terminal PCB. 2. Check cabling to IO board J101 at both ends. (No cable on J103).
• Panel buttons malfunctions.	1. Defective buttons or interface. 2. One button stuck.	1. Replace keyboard PCB or terminal PCB. 2. Check key switches or replace keyboard PCB.

Typical Status Screen (9) Contents



The status screen (9) contain information that will faciliate analysis and correction of several problems. A printout of the status and oscilloscope screens should be sent by fax/E-mail with any report about functional disturbance. This will greatly facilitate remote failure analysis.

If it at all is possible to cycle through the screens and observe this information, several assumptions may be made regarding operation of the GDS101 system. Although some of the subsystems necessary for this basic system operation may still suffer from minor or intermittent operation disorders, the fact that it is possible to select and observe this screen, indicate correct operation of the following GDS101 subsystems:

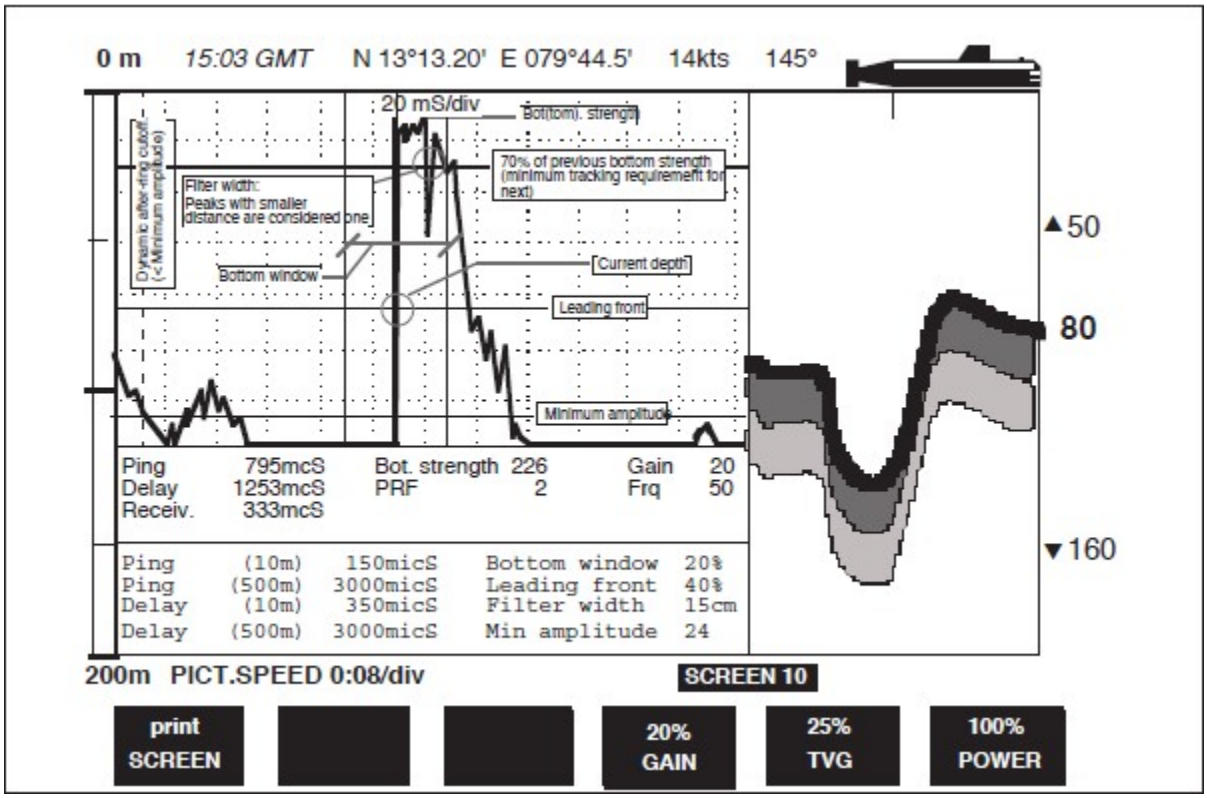
- The CPU board is operating.
- The keyboard interface board is working.
- The keyboard interface part of the I/O board is working.
- The power supplies on the terminal board are basically working.

Note: XCVR is linked to Power max (100 % = 40 - 48 V, 50 % = 22 - 25 V etc.). If the numbers are different, adjust your unit to the correct values and check if fault still occurs. Also ensure gain is not set to auto.

Symptom	Cause	Remedy
Status screen diagnosis		
Main voltages out of range • + 5 V: <> 4.50 - 5.00 V• + 12V: <> 11.00 - 12.00 V • Inv 12 V: <> 11.00 - 12.00 V	• Defective power supply. • Power supply overload.	• Replace terminal board. • +5 V: Computer or I/O board problem. • +12 V: Transceiver problem.
• Lost bottom, transceiver (XCVR) voltage low.	• Power setting too low.	• Increase power setting.
• Lost bottom, Transceiver (XCVR) voltage <10 V when power is 50 % or 100 %.	• Defective I/O card.	• Replace I/O card, possibly terminal board.
• System reboots intermittently.	• Bus cable or motherboard error.	• Temporary fix maybe to clean and reseat the motherbord connectors. • Replace cable and/or card.

The other information on the status screen is a collection of information which may be observed and manipulated with the various screen softkey selections. As a reference, it will often be more convenient to observe the various settings together on this screen than to cycle from screen to screen to check on the softkey texts

Typical Oscilloscope Screen (10) Contents



This oscilloscope screen 10 shows a typical oscillogram of a bottom echo (the tall peak in the centre of the diagram) and a weaker fish echo to the left of it. The horizontal axis represent time for the sound to travel down and back from an object. The vessel is located at the left edge of the grid, and the right edge represent the depth range. The vertical axis represent the magnitude of the echo signal received.

The length of the ping and the delay between pings, will adjust between preset limits (ping (10 m) and ping (500 m)). The actual length of these extremes are shown here.

Symptom	Cause	Remedy
Basic Functionality		
• No bottom detection or bottom contour.	• Too low gain setting. • Too low TVG setting. • Too low power setting. • Wrong frequency selection.	• Adjust settings. • Select correct frequency.
• Bottom tracking is intermittent or erroneous.	• Marginal gain, TVG or power settings. • Weather conditions. Transducerinstallation faulty.	• Adjust settings. • Try adjust gain, TVG or power settings. • Check transducer wiring, receiver LED on interface board or oscilloscope screen.

• Bottom tracking is masked by high noise levels.	• Too high gain setting. • Too high TVG setting. • Too high power setting.	• Adjust settings

Symptom	Cause	Remedy
NMEA Interface etc.		
• NMEA input signals are not listed in the NMEA screen.	• Wrong polarity input signals.	• Swap NMEA 0183 input wires.
• NMEA input signals are listed in the NMEA screen,but not accepted by the GDS101.	• GDS101 initialization. • Irregular message mnemonic.	• Cycle GDS101 power after NMEA connection is established.
• NMEA signals are not accepted by the remote system.	• Remote (listener) setup.	• Verify correct remote (listener) setup.
• Analogue output malfunctions.	• Incorrect range setting.	• Verify upper and lower limits in screen 6.
• Pulse output malfunctions.	• Incorrect pulse frequency setting.	• Verify pulse settings in screen 6.
• External control inputs malfunction, inhibit/ external printer control.	• Incorrect polarity or function settings.	• Verify settings in screen 6.

3 FE700

3.1 System overview

General

 The operator of this equipment must read and follow the descriptions in this manual. Wrong
operation or maintenance can cancel the warranty or cause injury.
 Do not copy any part of this manual without written permission from FURUNO.
 If this manual is lost or worn, contact your dealer about replacement.
 The contents of this manual and equipment specifications can change without notice.
 The example screens (or illustrations) shown in this manual can be different from the
screens you see on your display. The screens you see depend on your system configuration and equipment settings.
 Save this manual for future reference.
 Any modification of the equipment (including software) by persons not authorized by FURUNO will cancel the warranty.
 All brand and product names are trademarks, registered trademarks or service marks of their respective holders.

How to discard this product

Discard this product according to local regulations for the disposal of industrial waste. For disposal in
the USA, see the homepage of the Electronics Industries Alliance (http://www.eiae.org/) for the correct method of disposal.

How to discard a used battery

Some FURUNO products have a battery(ies). To see if your product has a battery(ies), see the chapter on Maintenance. Follow the instructions below if a battery(ies) is used.

In the European Union

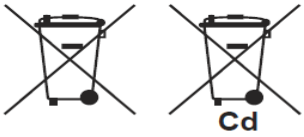
The crossed-out trash can symbol indicates that all types of batteries must not be discarded in standard trash, or at a trash site. Take the used batteries to a battery collection site according to your national legislation and the Batteries Directive 2006/66/EU.

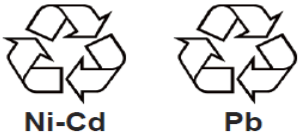
In the USA

The Mobius loop symbol (three chasing arrows) indicates that Ni-Cd and lead-acid rechargeable batteries must be recycled. Take the used batteries to a battery collection site according to local laws.

In the other countries

There are no international standards for the battery recycle symbol. The number of symbols can increase when the other countries make their own recycling symbols in the future.





⚠ SAFETY INSTRUCTIONS

⚠ WARNING

ELECTRICAL SHOCK HAZARD
Do not open the equipment.

Only qualified personnel should work inside the equipment.

⚠ CAUTION

Do not power the equipment when the transducer is in air.

The transducer may become damaged.

Immediately turn off the power at the switchboard if water leaks into the equipment.

Continued use of the equipment can cause fire or electrical shock. Contact a FURUNO agent for service.

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Immediately turn off the power at the switchboard if the equipment is emitting smoke or fire.

Continued use of the equipment can cause fire or electrical shock. Contact a FURUNO agent for service.

Make sure no rain or water splash leaks into the equipment.

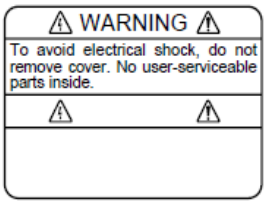
Fire or electrical shock can result if water leaks in the equipment.

Use the proper fuse.

Use of a wrong fuse can result in equipment damage and void the warranty.

WARNING LABEL

A warning label is attached to the equipment. Do not remove the label. If the label is missing or illegible, contact a FURUNO agent or dealer.



Name: Warning Label (1)
Type: 86-003-1011-1
Code No.: 100-236-231

About the TFT LCD

The TFT LCD is constructed using the latest LCD techniques, and displays 99.99% of its pixels. The remaining 0.01% of the pixels may drop out or blink, however this is not an indication of malfunction.

FOREWORD

A Word to FE-700 Owners

Thank you for purchasing this navigational echo sounder. We are confident you will discover why
FURUNO has become synonymous with quality and reliability.

Dedicated in the design and manufacture of marine electronics equipment for over 60 years,
FURUNO Electric Company has gained an unrivaled reputation as a world leader in the industry. This is the result of our technical excellence as well as our worldwide distribution and service network.

Please carefully read and follow the safety
information and operating and maintenance instructions set forth in this manual before attempting to operate the equipment and conduct any maintenance. Your navigational echo sounder will perform to the utmost of its ability only if it is operated and maintained in accordance with the correct procedures. This equipment is designed, produced and
documented by FURUNO ELECTRIC CO., LTD.,complying with ISO 9001 standards as certified by the Lloyd's Register of Quality Assurance System.

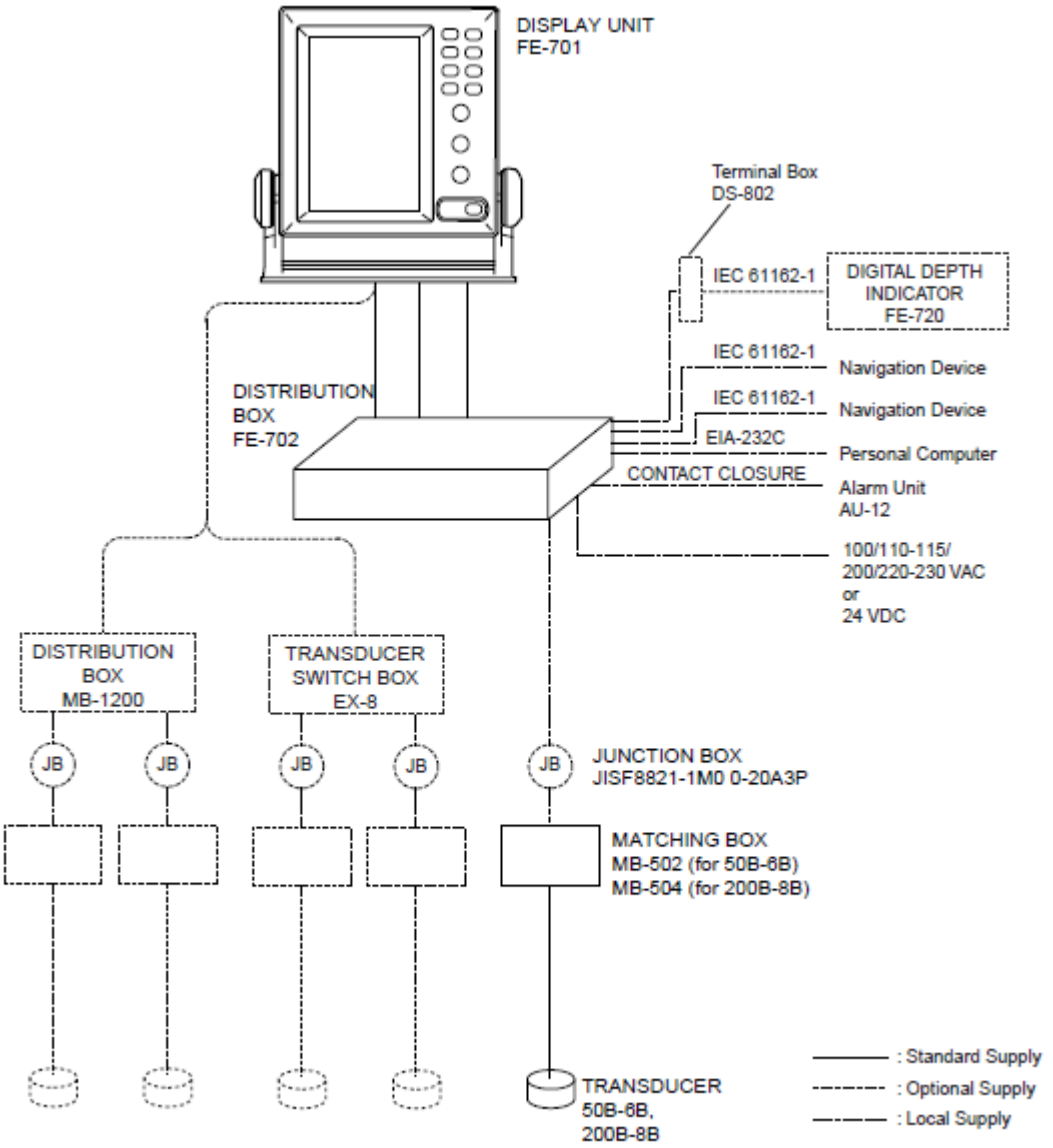
Features

The FURUNO FE-700 is comprised of display unit and transducer unit. Echo sounding data is displayed on the bright 6.5-inch color TFT (Thin Film Transistor) LCD display.

The main features of the FE-700 are:

1. Complies with the IMO and ISO standards MSC.74(69) Annex 4 and ISO9875.
2. Cost-effective; no paper, no consumables; high accuracy and high reliability - no rotating gears and belts as in the paper echo sounders
3. High-contrast 6.5-inch color LCD display featuring a wide viewing angle and adjustable
brightness.
4. Wide variety of modes with never-get-lost default position.
5. Automatic function permits unattended adjustment of range, gain, and pulselength. The range scale and gain automatically change to display the bottom.
6. Position, course, speed, time are repeated from the external devices.
7. Alarms: shallow water, bottom lost, power drop.
8. The dual frequency display can be shown by using the optional matching box MB-1200.

SYSTEM CONFIGURATION



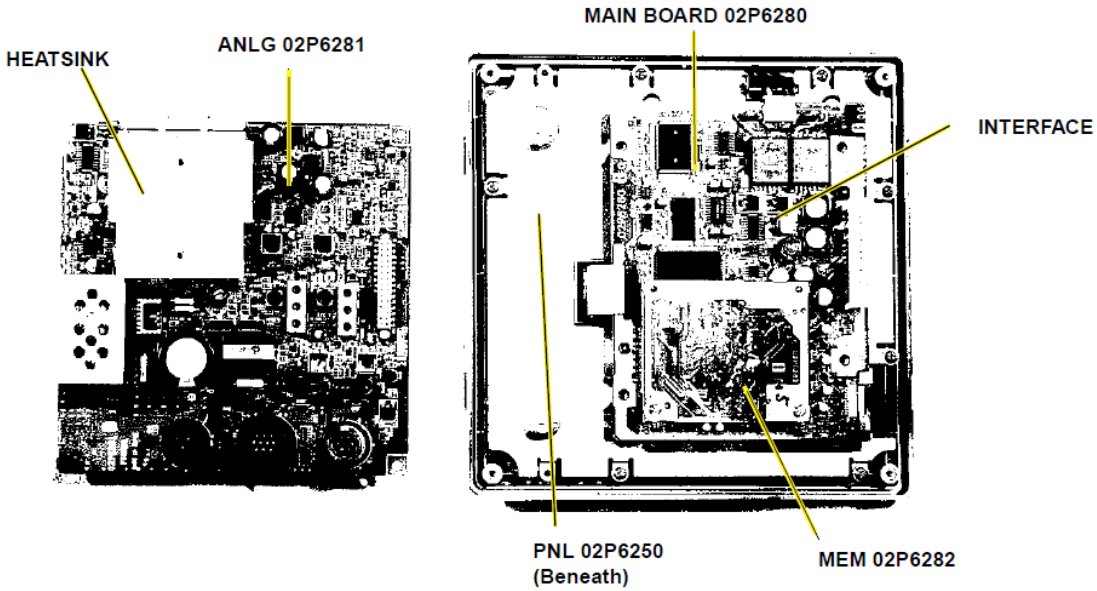
FE-700 system configuration

PRINCIPLE OF OPERATION

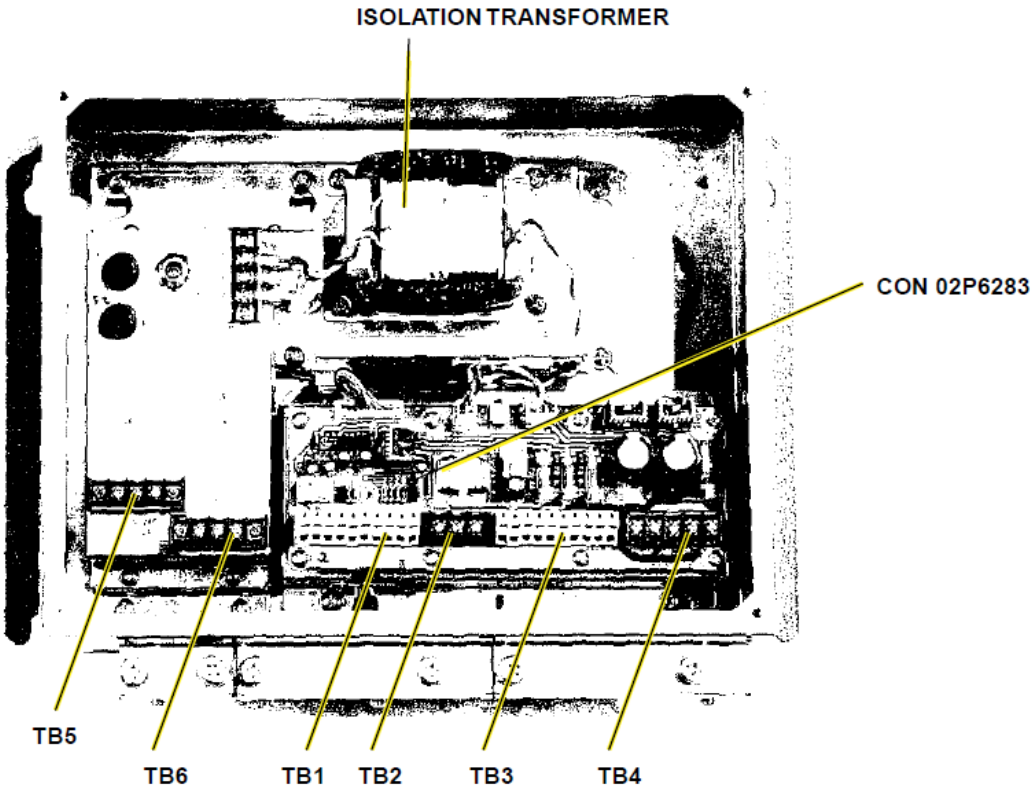
The FE-700 uses ultrasonic pulses to detect the seabed and other underwater objects. The display unit contains all basic electric circuits and logic processor. Electrical pulses are converted into acoustical energy in the transducer fitted on the ship's hull. The processor measures the time of pulses travelling between the seabed and transducer and displays the water depths in the graphical form or other forms.

The transducers have a specific beam width with respect to their working frequency, 50 kHz or 200 kHz. The high frequency has a narrow beamwidth and is immune to aeration when the ship is going astern or in rough weather. The low frequency has a wide beamwidth and more powerful sounding capability.

PARTS LOCATION, PARTS LIST



MAIN DISPLAY UNIT FE-701, INSIDE VIEW(SHIELD COVER REMOVED)



DISTRIBUTION BOX FE-702,INSIDE VIEW

3.2 Technical data

SPECIFICATIONS OF NAVIGATIONAL ECHO SOUNDER

FE-700

1 GENERAL

1.1 Transmit frequency 50 kHz, 200 kHz, or 50/200 kHz alternating transmit

1.2 Output power 600 Wrms

1.3 Beam width 50B-6B (50 kHz): 35°, 200B-8B (200 kHz): 6°

1.4 Basic display range

Unit	Range							
	1	2	3	4	5	6	7	8
Meter	5	10	20	40	100	200	400	800
Feet	15	30	60	120	300	600	1500	2500
Fathom	3	5	10	20	50	100	200	400

*Default settings; it could be customized for use w/o range 3 and 6.

1.5 Minimum range 0.5 m (200 kHz), 2.0 m (50 kHz)

1.6 Draft 0 to 30 m in 0.1 m steps, default 0 m

1.7 Pulse repetition rate (PRR)

Depth (m)	P/L (ms)	PRR (pulse/min)
5, 10, 20	0.25	750
40	0.38	375
100	1.00	150
200	2.00	75
400,800	3.60	42

2 DISPLAY UNIT

2.1 Graphical display 6.5-inch color TFT LCD, 320 x 234 pixels

2.2 Echo colors 8 colors or 8 level monochrome

2.3 Display area 133 x 97 mm

2.4 Display mode

“NAV”: Basic echo presentation with the depth below transducer (or keel)

“DBS”: Echo presentation with the depth below sea surface

“HISTRY”: Historical Echo presentation with the depth

“LOGBOOK”: Echo presentation with the pop-up table showing

Time, Depth and L/L* data memorized at preset interval

“OS DATA”: Echo presentation with the pop-up table of present navigational data; L/L*, course*, speed*, time, depth

“HELP”: Echo presentation with the help menu and note

“MENU”: Echo presentation with the user menu

2.5 Picture advance speed

Slow mode 15 minutes or more

Fast mode Picture advance range

Range (m)	5	10	20	40	100	200	400	800
Interval (min.)	1.8			8		20	30	

2.6 User setting Gain, Range, Alarm, Draft, Brilliance, Dimmer, Color, Auto

2.7 Auto set mode Gain, range and clutter will be automatically adjusted.

2.8 Alarm Shallow water (default 20 m), Bottom lost, Power drop

2.9 Logbook display Depth, Internal clock, L/L*

1 hour at 5 sec Interval, 12 hours at 1 minute interval and 24

hours at 2 minutes interval

*: External navigational sensor required.

3 DIGITAL DEPTH INDICATOR

3.1 Display 4.5-inch monochrome LCD

3.2 Depth indication **.* m (less than 100m), **** m (100 m or more)

4 INTERFACE

4.1 Serial input data

IEC61162-1, current loop; 1 port

RMA: L/L, Ground track speed, Track

RMC: L/L (GPS), Ground track speed, Track, Time

GGA/GLL: L/L

VTG: Ground track speed, Track (true/magnetic selected on menu)

ZDA: Time

4.2 Serial output data

IEC61162-1, output period: 1 sec.; 3 outputs/ 1 port

SDDPT: Depth (m), Draft (m)

SDDBT: Depth (ft, m, fa) below transducer

SDDBK: Depth (ft, m, fa) below keel

SDDBS: Depth (ft, m, fa) below sea surface

4.3 Serial I/O data RS-232C, 1 port

Output Depth, Clock, L/L, Ship's speed, Course

Input Control command for PC

4.4 Alarm (Depth, Power) Contact closure signal, normal open or normal close,

250 VAC/ 200 VDC, 3A max.

5 POWER SUPPLY

5.1 Distribution box (FE-720)

100/110-115/200/220-230 VAC: 0.2 A max., 1 phase, 50/60Hz or 24 VDC: 0.6 A

5.2 Digital depth indicator 24 VDC, 0.15A

6 ENVIRONMENTAL CONDITION

6.1 Temperature -15°C to +55°C

6.2 Relative humidity 93% at +40°C

6.3 Degree of protection

Display unit, Digital depth indicator IPX5

Distribution box, Matching box IPX2

6.4 Vibration IEC 60945

6.5 EMC IEC 60945

7 COATING COLOR

7.1 Display unit Panel: N3.0, Chassis: 2.5GY5/1.5 (fixed)

7.2 Digital depth indicator Panel: N3.0, Chassis: 2.5GY5/1.5 (fixed)

7.3 Distribution box (FE-720) 2.5GY5/1.5 or 7.5BG7/2

7.4 Distribution box (MB-1200) N3.0

7.5 Matching box 2.5G7/2 (fixed)

DIGITAL INTERFACE(IEC 61162-1 EDITION 2)

1. I/O Sentences

Input sentences of channel 1 (NAV IN)

RMA, RMC, GLL, GGA, VTG, ZDA

Output sentences of channel 2 (NAV OUT)

DBT, DPT, DBS (NMEA 0183), DBK (NMEA 0183)

Transmission interval

1 s for any sentence

Data transmission

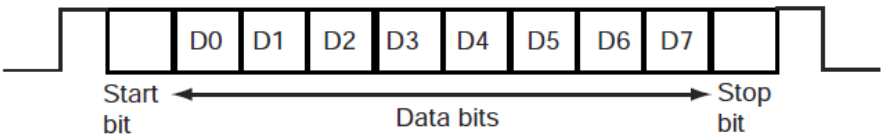
Data is transmitted in serial asynchronous form in accordance with the standard referenced in 2.1 of IEC 61162-1. The first bit is a start bit and is followed by data bits, least-significant-bit as illustrated below.

The following parameters are used:

Baud rate: 4800

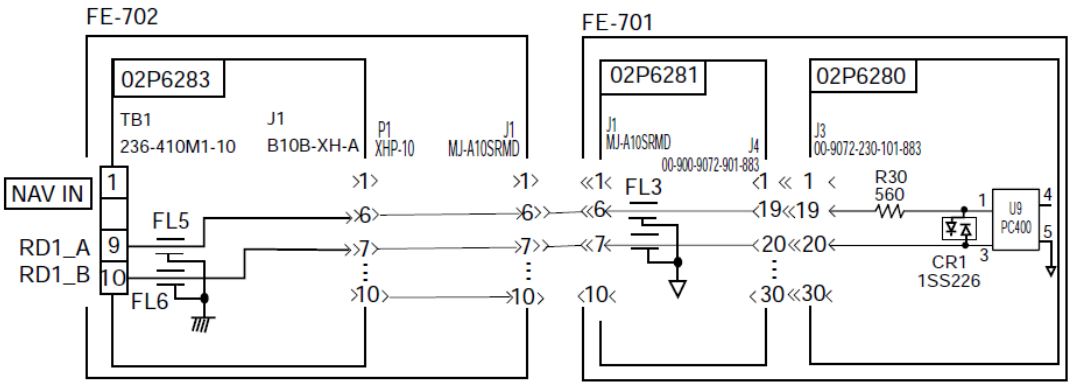
Data bits: 8 (D7 = 0), parity none

Stop bits: 1



2. Schematic Diagrams

NAV IN port (listener)



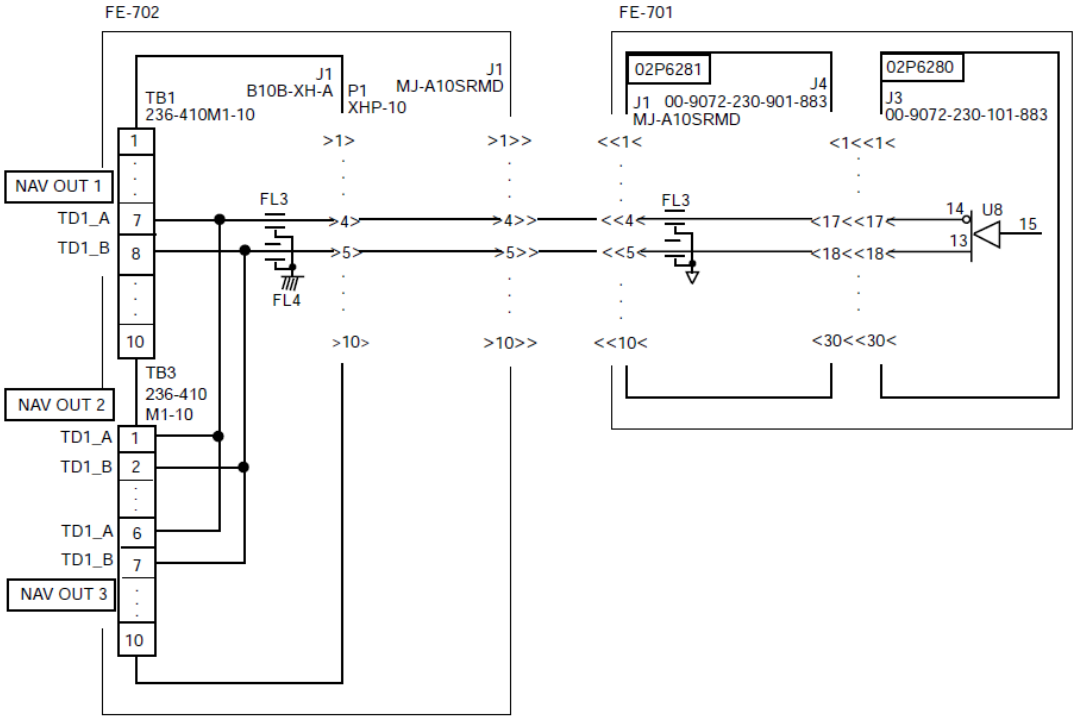
Load requirements as listener

Isolation: Optocoupler

Input Impedance: 560 ohms

Max. Voltage: ±15V

NAV OUT ports



Total output for NAV OUT ports: Max. 20 mA

3. Sentence Description DPT – Depth

```
$--DPT,x.x,x.x,x.x*hh<CR><LF>
       |   |   |  |
       |   |   |  +----- 4
       |   |   +-------- 3
       |   +------------ 2
       +---------------- 1
```

1. Water depth relative to trancsducer, in meters

2. Offset from transeducer, in meters(see notes 1 and 2)

3. Maximum range scale in use

4. Checksum

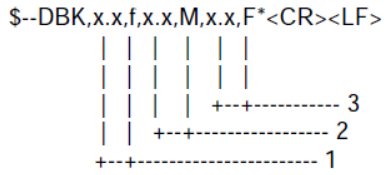
NOTE1 "positive"=distance from transeduser to water-line.

"-"=distance from transducer to keel.

NOTE2 For IEC applications the offset should always be applied

so as to provide depth relative to the keel.

DBK – Depth below keel

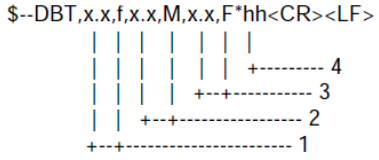


1. Water depth, feet

2. Water depth, m

3. Water depth, fathoms

DBT – Depth below transducer



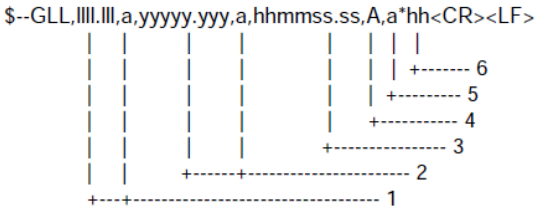
1. Water depth, feet

2. Water depth, m

3. Water depth, fathoms

4. Checksum

GLL - Geographic position - latitude/longitude



1. Latitude, N/S

2. Longitude, E/W

3. UTC of position

4. Status: A=data valid, V=data invalid

5. Mode indicator(see note)

6. Checksum

NOTE Positioning system Mode indicator:

A = Autonomous

D = Differential

E = Estimated (dead reckoning)

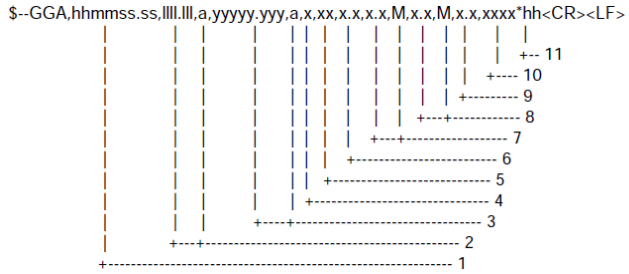
M = Manual input

S = Simulator

N = Data not valid

The Mode indicator field supplements the Status field. The Status field shall be set to V=invalid for all values of Operating Mode except for A=Autonomous and D=Differential. The positioning system Mode indicator and Status field shall not be null fields.

GGA - Global positioning system (GPS) fix data



1. UTC of position

2. Latitude, N/S

3. Longitude, E/W

4. GPS quality indicator (see note)

5. Number of satllite in use,00-12, may be different from the number in view

6. Horizontal dilution of precision

7. Antenna altitude above/below mean sealevel, m

8. Geoidal separation, m

9. Age of differential GPS data

10. Differential reference station ID, 0000-1023

11. Checksum

NOTE

0 = fix not available or invalid

1 = GPS SPS mode, fix valid

2 = differential GPS, SPS mode, fix valid

3 = GPS PPS mode, fix valid

4 = Real Time Kinetic. Satellite system used in RTK mode with fixed integers

5 = Float RTK. Satellite system used in RTK mode with floating fingers

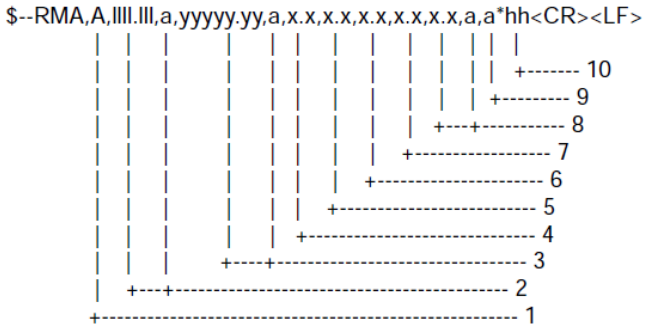
6 = Estimated (dead reckoning) mode

7 = Manual input mode

8 = Simulator mode

The GPS quality indicator shall not be a null field.

RMA - Recommended minimum specific LORAN-C data



1. Status: A=data valid, V=blink, cycle or SNR warning
2. Latitude, degrees N/S
3. Longitude, degrees E/W
4. Time difference A, microseconds
5. Time difference B, microseconds
6. Speed over ground, knots
7. Course over ground, degrees true
8. Magnetic variation(see note 1),degree E/W
9. Mode indicator(see note 2)
10. Checksum

NOTE 1 - Easterly variation(E) subtracts from true course

Westerly variation(W) adds to true course

NOTE 2 Positioning system Mode indicator:

A = Autonomous

D = Differential

E = Estimated (dead reckoning)

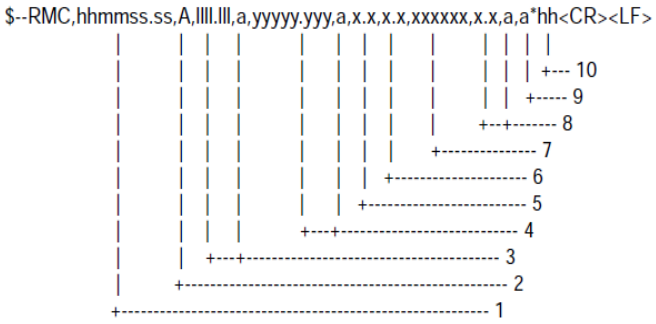
M = Manual input

S = Simulator

N = Data not valid

The Mode indicator field supplements the Status field. The Status field shall be set to V=invalid for all values of Operating Mode except for A=Autonomous and D=Differential. The positioning system Mode indicator and Status field shall not be null fields.

RMC - Recommended specific GPS/TRANSIT data



1. UTC of position fix
2. Status: A=data valid, V=navigation receiver warning
3. Latitude, N/S
4. Longitude, E/W
5. Speed over ground, knots
6. Course over ground, degrees true
7. Date: dd/mm/yy
8. magnetic variation, degrees E/W
9. Mode indicator(see note)
10. Checksum

NOTE Positioning system Mode indicator:

A = Autonomous

D = Differential

E = Estimated (dead reckoning)

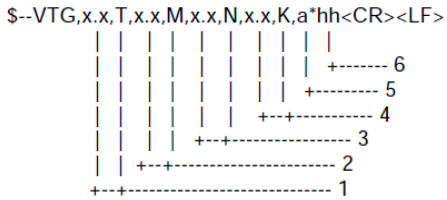
M = Manual input

S = Simulator

N = Data not valid

The Mode indicator field supplements the Status field. The Status field shall be set to V=invalid for all values of Operating Mode except for A=Autonomous and D=Differential. The positioning system Mode indicator and Status field shall not be null fields.

VTG- Course over ground and ground speed



1. Course over ground, degrees true

2. Course over ground, degrees magnetic

3. Speed over ground, knots

4. Speed over ground, km/h

5. Mode indicator(see note)

6. Checksum

NOTE Positioning system Mode indicator:

A = Autonomous

D = Differential

E = Estimated (dead reckoning)

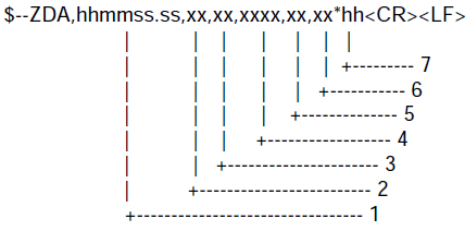
M = Manual input

S = Simulator

N = Data not valid

The positioning system Mode indicator field shall not be a null field.

ZDA - Time and date



1. UTC

2. Day, 01 to 31(UTC)

3. Month, 01 to 12(UTC)

4. Year(UTC)

5. Local zone hours, 00h to +-13h

6. Local zone minutes, 00 to +59 as local hours

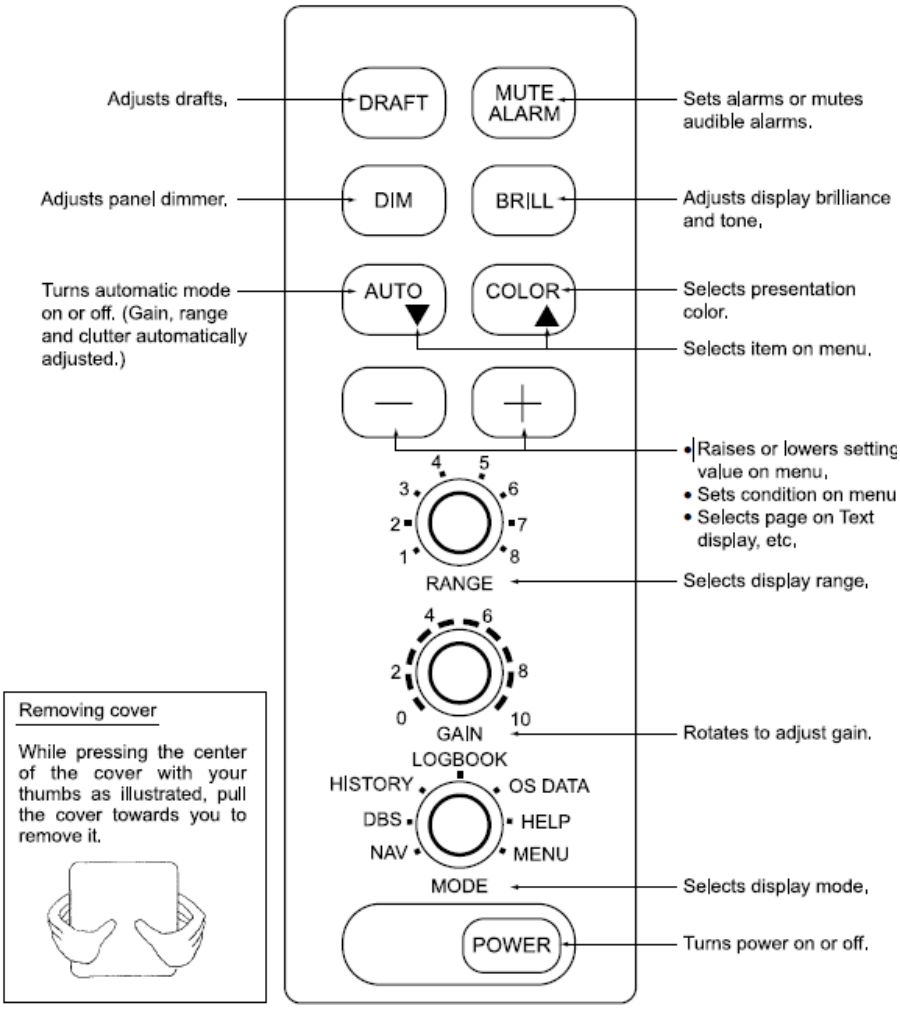
7. Checksum

3.3 Operation

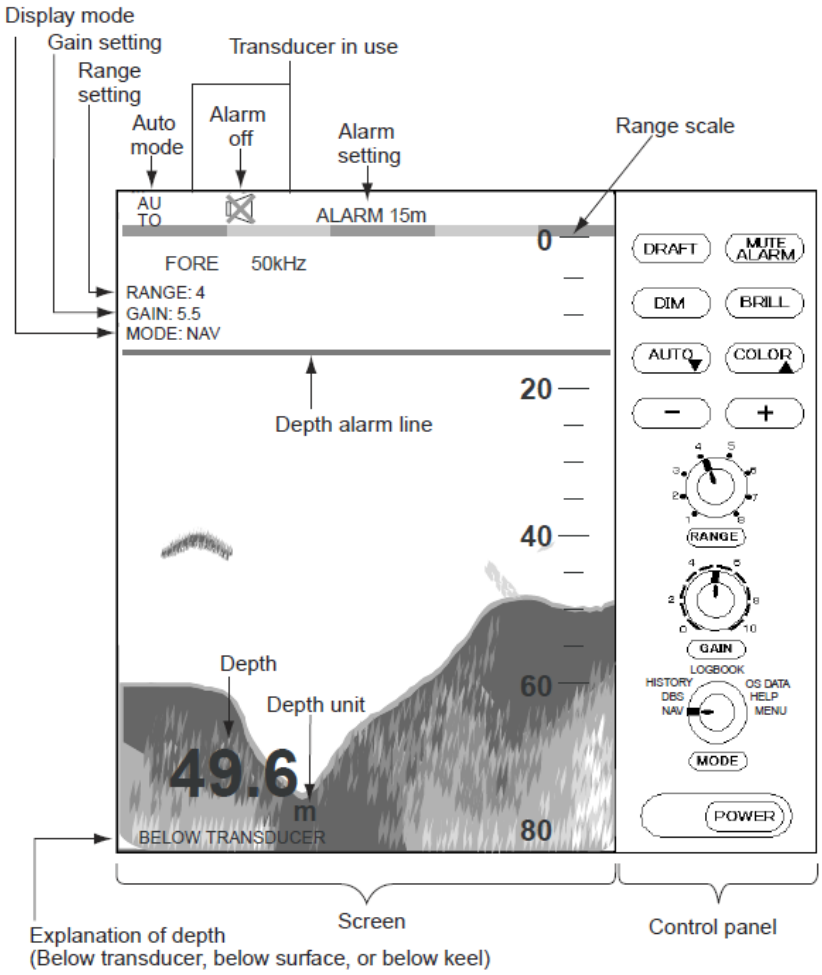
3.3.1 Control Description

All operation of the FE-700 is carried out with the controls on the front panel of the

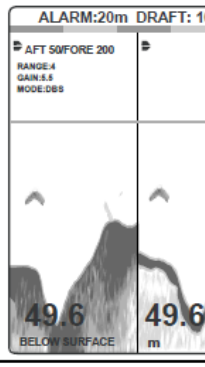
display unit. Rotary controls respond immediately to your command but some touch keys require the successive operation.



3.3.2 Indications, Markers



Ex. Single frequency display



When connecting two transducers via the optional distributor box MB-1200, the dual frequency display (as left) can be shown. To switch SINGLE and DUAL, see the Installation Manual.

3.3.3 Turning On/Off

1. Turning on: Press the POWER Switch.Self-test starts, showing the condition of the

logic circuits. The program number is displayed.

ROM: OK

DRAM: OK

SRAM: OK

BATTERY: OK

PROGRAM NO. 02522970xx

2. Select a mode with the MODE Selector. The NAV position of the selector is recommended for general use. Display color is amber by default but may be customized. The unit of measurement is meters. You can freely select another mode at any time.

3. Turning off: Press the POWER Switch again.Wait at least 5 s before reapplying the power.

Note: When two transducers are installed, make sure which transducer is used.

Note: When lat/long data input error occurs,“EPFS” ERROR appears on the screen. (EPFS: Electronic Position-Fixing System such as GPS receiver)

3.3.4 Tone and Brilliance

1. Press the BRILL key. The tone and brilliance setting window appears.

2. Press the [+] or [-] key for desired tone (in reality, Contrast).

3. Press the [▲] or [▼] key for desired brilliance. Pressing the BRILL key also changes the brilliance from minimum to maximum and vice-versa.

Note: Tone or brilliance must be adjusted within 10 seconds after pressing the BRILL key. Otherwise the tone and brilliance window will be erased.

3.3.5 Panel Dimmer

1. Press the DIM key. The panel dimmer setting window appears.

2. Press the [+] or [-] key for desired illumination of the control panel. Pressing DIM key also changes the illumination level.

3.3.6 Display Mode

The Mode Selector choose the display mode among NAV, DBS (depth below surface), HISTORY, LOGBOOK, OS DATA, HELP, and MENU.

3.3.6.1 NAV mode

The depth from the transducer to the seabed (bottom clearance) is shown on the screen. Note “BELOW TRANSDUCER” appears at the bottom of the screen in this mode. If the transducer setting is DEPTH BELOW KEEL, “BELOW KEEL” appears at the bottom of the screen. Default is,

Color: Amber

Range: Automatic range switching

Window: 15 minutes

Shallow depth alarm: 20 m

NOTE: These parameters can be customized to your preference and the last setting is used at a next switch-on. This is true on all other modes.

3.3.6.2 DBS mode

The Depth Below Surface mode provides a draft-adjusted depth reading and will be useful in referencing to the nautical chart. The draft should be adjusted by the DRAFT key according to the actual draft value. If you find any difficulty tocheck for the draft value, use the NAV mode.

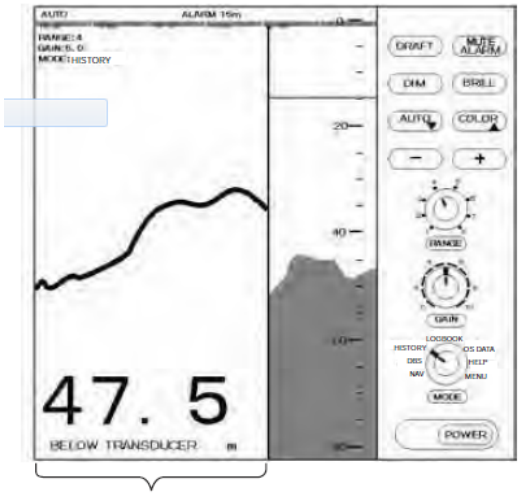
When the DBS mode is selected, the message “Confirm and set ship’s draft to use DBS mode” appears. Confirm ship's draft and set it by referring to section 1.12. BELOW SURFACE appears at the bottom of the display and the draft value appears at the upper right-hand corner in the DBS mode.

⚠ CAUTION

DBS is not a water clearance below keel.
Do not use this mode in shallow waters to avoid grounding.

3.3.6.3 HISTORY mode

This mode provides a mix of Contour and Strata displays. The Contour display can be scrolled over the past 24 h while the right side Strata display (layers of different colors according to reverberation strengths) shows the latest sounding for 5 minutes. Pressing the [+] or [-] key moves the Contour display forwards or backwards, respectively.



History of the bottom

If the range scale for both the Contour and Strata display must be the same. If they are not, the message “OUT OF RANGE” appears.
The update of the contour data may take max. one minute. Wait for one minute to display
accurate contour if you change the range scale.

3.3.6.4 LOGBOOK mode

The LOGBOOK shows time, depth and own ship position in tabular form in a pop-up

window. The logging is selected with the INTERVAL option on the menu among 5 s, 1 min and 2 min. (Seesection 2.6.)

There are 60 pages and the total memory capacity is 720 points. Page 60/60 is the latest

data and 1/60 is the oldest data. Pressing [-] or [+] key changes the pages.

Note that if DEPTH BELOW KEEL is chosen, DBK also appears together with depth indication in the DEPTH column.

60/60

TIME	DEPTH	L/L
11:00:00	47.5	36° 55.012'N 135° 23.123'E
11:01:00	47.5	36° 55.012'N 135° 23.123'E
11:02:00	47.5	36° 55.012'N 135° 23.123'E
11:03:00	47.5	36° 55.012'N 135° 23.123'E
11:04:00	47.5	36° 55.014'N 135° 23.123'E
11:05:00	47.5	36° 55.014'N 135° 23.123'E

(Single display)

60/60

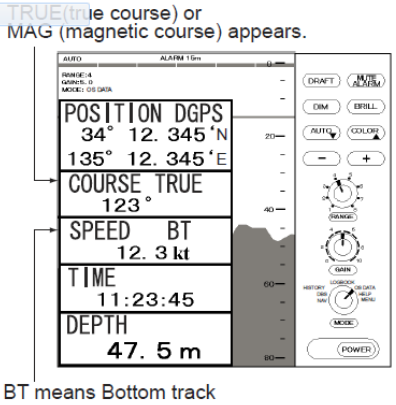
TIME	DEPTH	L/L
FORE 50kHz		
11:00:00	47.0	36° 55.012'N 135° 23.123'E
11:01:00	46.2	36° 55.012'N 135° 23.123'E
11:02:00	46.0	36° 55.012'N 135° 23.123'E
11:03:00	45.8	36° 55.012'N 135° 23.123'E
11:04:00	45.5	36° 55.014'N 135° 23.123'E
AFT 200kHz		
11:00:00	45.1	36° 55.012'N 135° 23.123'E
11:01:00	45.0	36° 55.012'N 135° 23.123'E
11:02:00	44.9	36° 55.012'N 135° 23.123'E
11:03:00	44.6	36° 55.012'N 135° 23.123'E
11:04:00	44.5	36° 55.014'N 135° 23.123'E

(Dual display)

* Depth below keel shown when transducer setting is DEPTH BELOW KEEL.

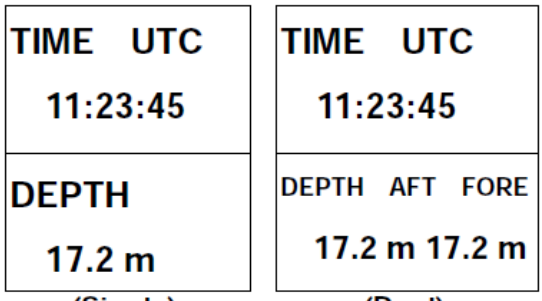
3.3.6.5 OS DATA mode

This display mode indicates own ship position,GPS-derived course and speed, and time and depth in digital form. You can read the data of your particular interest in large characters. The screen continues to display the sounding data in the background. Part of graphical indication is visible to the right of data slips.



There are two kinds of OS DATA displays: DATA 1 and DATA 2, as selected on the system menu. DATA 1 is shown in the figure above.

The DATA 2 display is as below.



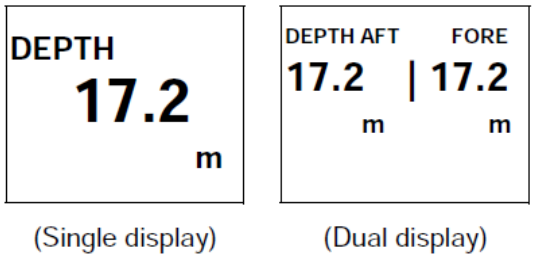
Note: When lat/long data input error occurs in the DATA 1 mode, “EPFS” ERROR appears on the screen. (EPFS: Electronic Position-Fixing System such as GPS receiver)

Enlarging data of interest

You can enlarge one of the data indications as follows:

1. Press the [▲] or [▼] key to select the data you want to enlarge. Current section is circumscribed with the blue cursor. For example, select the depth cell.

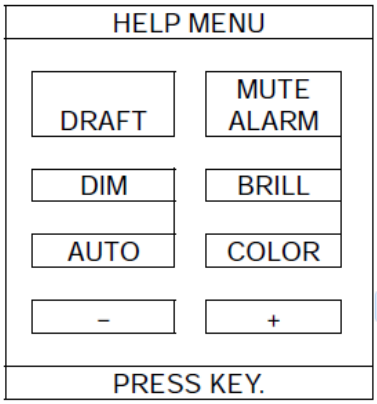
2. Press the [+] key.

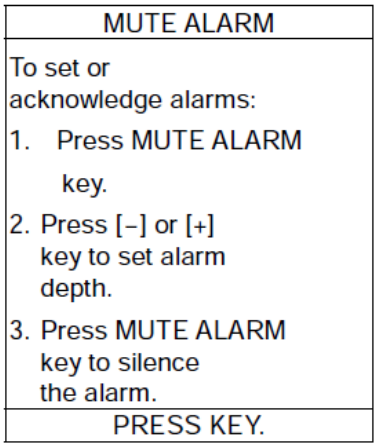


3. To return to the original display, press the [-] key.

1.6.6 HELP display

This mode provides information about keys. Press desired key to obtain the corresponding information. The example below shows help information for MUTE ALARM.

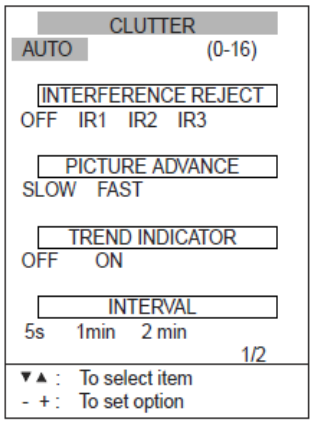



MUTE ALARM
To set or acknowledge alarms:
1. Press MUTE ALARM key.
2. Press [–] or [+] key to set alarm depth.
3. Press MUTE ALARM key to silence the alarm.
PRESS KEY.

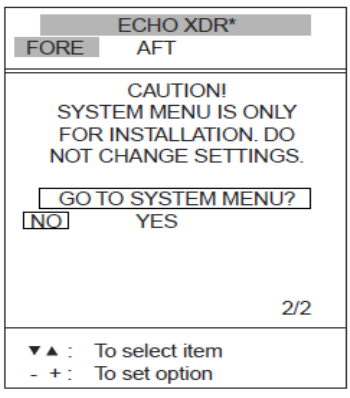
3.3.6.7 MENU display

The menu provides functions which normally do not require frequent adjustment. For details see Chapter 2.

Press the [▼] key when the cursor is on the “INTERVAL”, and the following appears.



(Page 1/2)



(Page 2/2)

*For Dual display, "HISTORY XDR" appears.

3.3.7 Range Scale

If the depth goes out of the correct display area,increase or decrease the range until the seabed appears near the center of the screen.
Adjust the Range Control, and current range selection is shown in the range display window.
In the AUTO mode, the range scale is automatically adjusted. See section 1.9 for details.

3.3.8 Gain Control

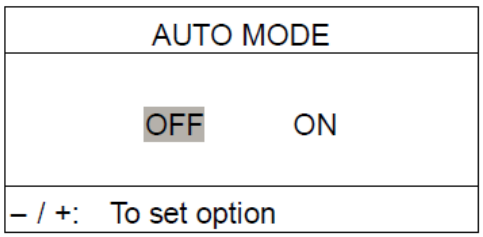
The GAIN Control adjusts the sensitivity of the receiver. The AUTO mode provides automatic adjustment and you are normally not required to adjust it. Current setting is shown at the upper left-hand corner. Adjust the GAIN Control and the following window appears.
Adjust the GAIN Control so that a slight amount of noise remains on the screen. Generally, use a higher gain setting for greater depths and a lower setting for shallower waters. Adjusting range is between 0.0 and 10.0 in 0.5 steps.

3.3.9 Automatic Operation

The automatic function automatically selects the proper gain, range scale and clutter level
according to depth. It works as follows:
 The range changes automatically to locate the bottom on the lower half of the screen. It jumps to one step shallower range when bottom echoes reach a halfway point of the full scale from top and to one step deeper range when they come to the lower edge of the scale.
 The gain is automatically adjusted to display the seabed in specified color.
 Clutter level (on the menu), which works as a threshold control to suppress overall noise, is automatically adjusted.
Note: The AUTO MODE is cancelled whenever the range or the gain is changed.

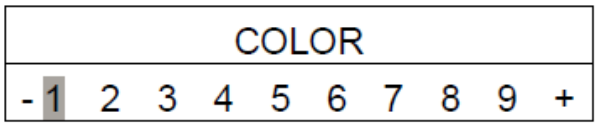
How to enable/disable automatic operation

1. Press the AUTO key. The AUTO mode window appears.
2. Press the [+] key to select ON or the [-] key to select OFF.



3.3.10 Picture Colors

1. Press the COLOR key. The following window appears.



2. Press the [+] or [-] key to select a number, referring to the table below. (You can see the
result of your selection on the display.)

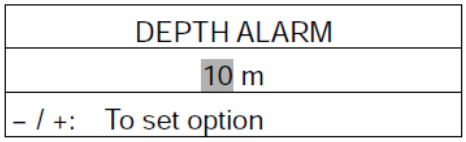
	Background	Seabed	Others marks
1	Monochrome, 8 intensities		
2	Blue	Red infill	6 colors
3	Black	Red infill	6 colors
4	White	Red infill	6 colors
5	Blue	Yellow infill	6 colors
6	Black	Yellow infill	6 colors
7	White	Yellow infill	6 colors
8	Black	7 colors (Strata)	
9	White	7 colors (Strata)	

Monochrome (amber) is the default setting. The Strata display contains multiple colors depending on the reflectivity from underwater objects of the sounding pulses. Red is strongest, followed by brown, orange, yellow, blue, and light blue at the

default setting.

3.3.11 Shallow Depth Alarm

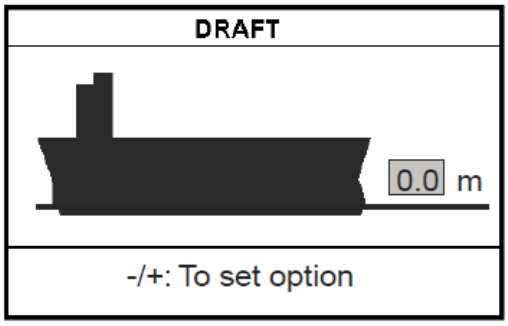
The shallow depth alarm sounds when the seabed is shallower than the preset depth. The
default in the NAV position is 20 m. You can adjust the alarm depth as below:
Activating/deactivating the alarm
1. Press the MUTE ALARM key to display the depth alarm setting window.



2. Press the [+] or [-] key to change setting depth. The setting is shown digitally at the top of the screen and graphically key the depth alarm line.
When the alarm is activated, the message “SHALLOW DEPTH ALARM” is displayed at the center on the screen.
Note: When the keel setting is 0.0 – 10.0 in the DBK mode, the shallow depth alarm setting will show a minus value. At this time, the alarm setting value indication shows “****” and the alarm function is disabled.
Acknowledging the alarm
You can silence the alarm by pressing the MUTE ALARM key. The message “SHALLOW DEPTH ALARM” moves to upper side of the screen.

3.3.12 Draft

It is necessary to set the draft to use the DBS display mode, which shows depth below surface. (Single display)
1. Select DBS with the MODE control. “Confirm and set ships draft to use DBS mode.” appears.
2. Press the DRAFT key to display the draft setting window.



3. Press the [+] key to increase the setting depth and [-] key to decrease it. The setting depth is 0 to 30 m in steps of 0.1 m.The above window disappears in 10 seconds.
The draft setting is displayed at the upper right corner and the range scale is shifted according to the draft setting.

(Dual display)

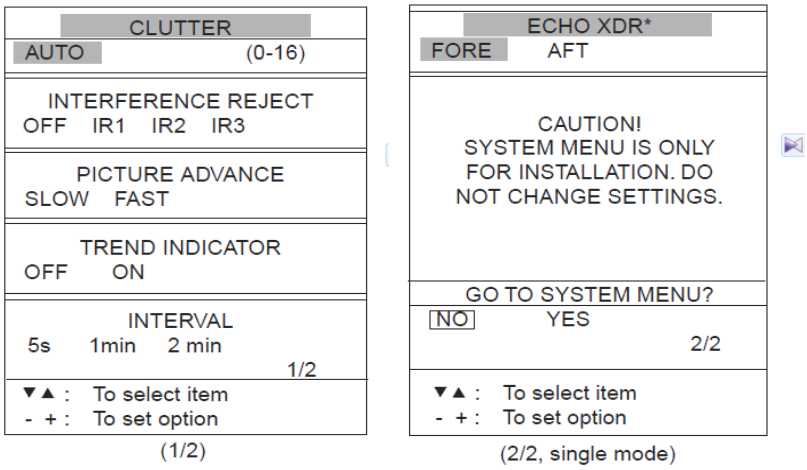
1. Select DBS with the MODE control. “Confirm and set ships draft to use DBS mode.” appears.
2. Press the [DRAFT] key to display the draft setting window for FORE.
3. Press the [+] key to increase the setting depth and [-] key to decrease it. The setting depth is 0 to 30 m in steps of 0.1 m. The above window disappears in 10 seconds.
4. Press the [DRAFT] key while the FORE setting window is shown, to display the draft
setting window for AFT.
5. Press the [+] key to increase the setting depth and [-] key to decrease it. The setting depth is 0 to 30 m in steps of 0.1 m. The above window disappears in 10 seconds.

MENU OPERATION

Menu Overview

The menu has several functions for advanced operation.

1. Select MENU with the MODE Selector.



2. Press the [▲] or [▼] key to select menu item. As you operate the [▲] or [▼] key, the

selected item and its current setting appear in reverse video.

3. Press the [-] or [+] key to select option desired.

4. Set the MODE Selector in another position to close the menu.

Suppressing Low Level

Noise

Light-blue dots may appear overall screen. This is mainly due to dirty water or noise. This noise can be suppressed by adjusting CLUTTER (in reality, Threshold of the amplifier).

When the automatic mode is on, the suppression setting is automatically adjusted. For manual override, do the following:

1. Select MENU with the MODE Selector.

2. Select CLUTTER by pressing the [▲] key.

3. Press the [-] or [+] key to select clutter rejection level desired. The higher the number the higher the degree of suppression. Note that weak echoes may not be displayed when the clutter circuit is on.

Suppressing Interference

Interference from other acoustic equipment operating nearby or other electronic equipment on your boat may show itself on the display. To suppress interference, do the following:

1. Select MENU with the MODE Selector.

2. Select INTERFERENCE REJECT by pressing the [▲] or [▼] key.

3. Press the [-] or [+] key to select degree of suppression desired; OFF, IR1, IR2 or IR3.

The higher the number the greater the degree of suppression. Note that oversuppression will weaken the sensitivity.

Picture Advance

The picture advance speed determines how quickly the vertical scan lines run across the screen.

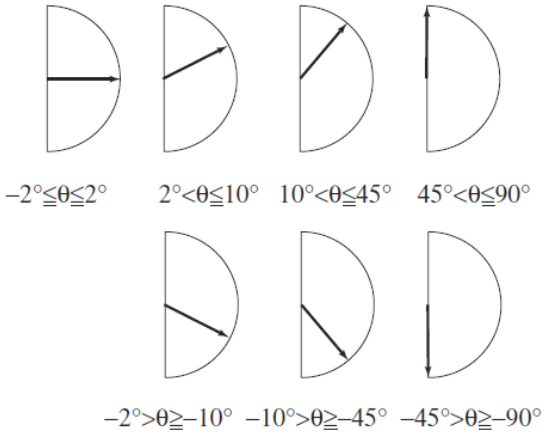
1. Select MENU with the MODE Selector.

2. Select PICTURE ADVANCE by pressing the [▲] or [▼] key.

3. Press the [+] or [-] key to select speed FAST or SLOW, respectively. The advance speed varies with the range scale and the viewing length of 15-16 minutes is available on all ranges (IMO requirements).

Trend

The future trend of the seabed depths can be predicted over a specified period of time (See page 13). The trend index is set with the item TREND INDICATOR and appears at the top left corner. The default setting is ON. θ is inclination angle of bottom.



Interval

The interval for sampling data for the LOGBOOK and HISTORY modes can be set with INTERVAL, among 5 s, 1 min and 2 min.The default setting is 1 min.

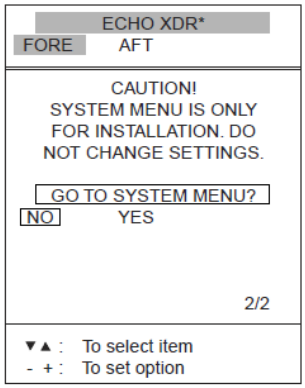
In this example, the setting of INTERVAL is 1 minute. That is, the depth and lat/long data are displayed at 1 minute intervals.

		3/60
TIME	DEPTH	L/L
11:00:00	47.5	36°55.012′N
		135°23.123′E
11:01:00	47.5	36°55.012′N
		135°23.123′E
11:02:00	47.5	36°55.013′N
		135°23.123′E
11:03:00	47.5	36°55.013′N
		135°23.123′E
11:04:00	47.5	36°55.014′N
		135°23.123′E
11:05:00	47.5	36°55.014′N
		135°23.123′E

Choosing the Transducer

Choose the transducer to use on all modes in the single display and HISTORY mode in the dual display.

1. Select MENU with the MODE Selector.
2. Select ECHO XDR (single display) or HISTORY XDR (dual display) by pressing the [▲] or [▼] key.
3. Press the [+] or [-] key to FORE or AFT.
4. Set the MODE Selector in another position to close the menu.



(Page 2/2)

*For Dual display, "HISTORY XDR" appears.

SYSTEM MENU

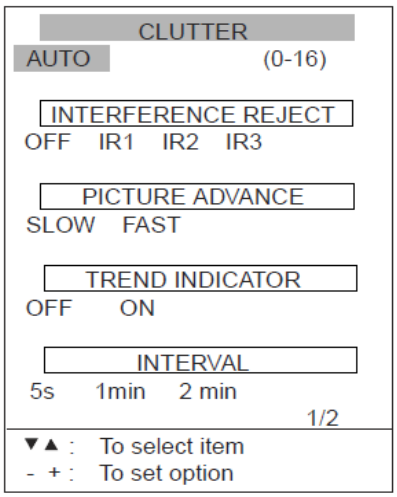
System Menu

The system menu should be set just after installation and is not always necessary to be

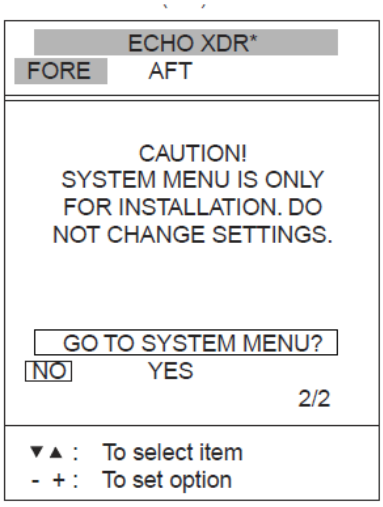
adjusted. If you change any items of the system menu or even if you open the system menu, the sounding picture will be cleared. There are three menus: 1,2,and 3.

1. Select MENU with the MODE Selector.

2. Press the [▼] key several times to display following window.



(1/2)



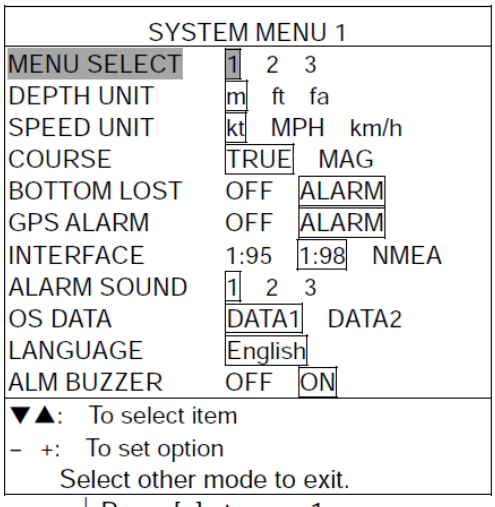
(2/2, single display)

*For the dual display. "HISTORY XDR" appears.

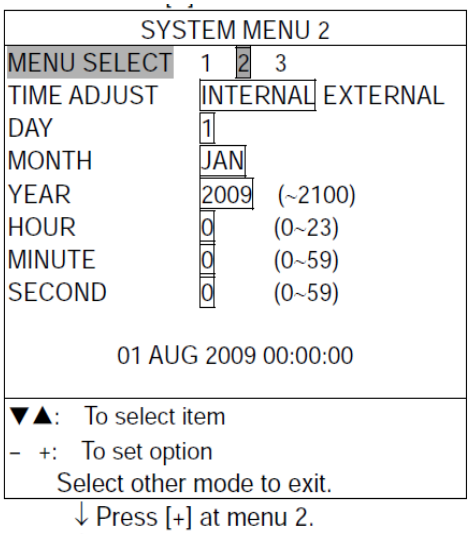
3. Select YES by pressing the [+] key. Confirmation message “ARE YOU SURE?” appears.

4.Press the [+] key again.The system menu 1 appears.

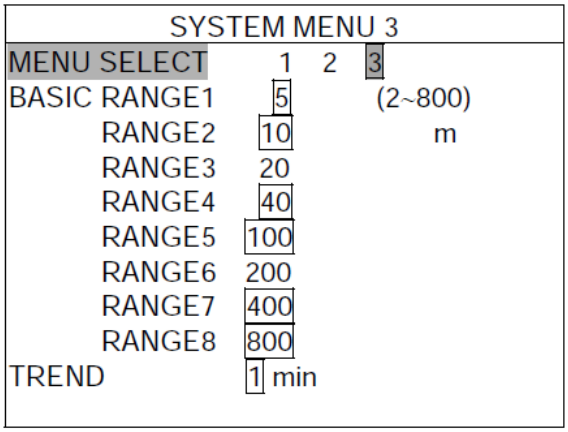
5. With the cursor selecting MENU SELECT,operate the [-] or [+] key to select system menu desired; 1, 2 or 3.


SYSTEM MENU 1
MENU SELECT 1 2 3
DEPTH UNIT m ft fa
SPEED UNIT kt MPH km/h
COURSE TRUE MAG
BOTTOM LOST OFF ALARM
GPS ALARM OFF ALARM
INTERFACE 1:95 1:98 NMEA
ALARM SOUND 1 2 3
OS DATA DATA1 DATA2
LANGUAGE English
ALM BUZZER OFF ON
▼▲: To select item
– +: To set option
Select other mode to exit.

↓ Press [+] at menu 1.
↑ Press [–] at menu 2.



↓ Press [+] at menu 2.
↑ Press [–] at menu 3.



System Menu 1

DEPTH UNIT: Selects unit of depth measurement among meters, feet, or fathoms. Default setting is meters. If "ft" or "fa" is selected, the depth unit is shown in red characters.

SPEED UNIT: Selects unit of speed measurement among knots, statute miles per hour, or kilometers per hour. Default setting is knots. Requires speed data, from external device.

COURSE: Selects heading reference; true or magnetic. Default setting is TRUE.

BOTTOM LOST: Turns on or off the bottom loss warning. “ALARM” sounds the alarm if the bottom signal is not detected. Default setting is “ALARM” (alarm is enabled).

GPS ALARM: The audible alarm may be released when the position-fixing mode is switched from DGPS to GPS and vice versa. Default setting is “ALARM” (alarm is enabled). Choose “OFF” if you do not need to be alerted with the audible alarm when the position-fixing mode is switched.

INTERFACE: Selects I/O signal format between the FE-700 and external equipment; IEC format “1:95” (1995 version) or “1:98” (1998 version), or NMEA format. Default setting is IEC “1:98”. When selecting the “1:98”, DPT has max. range in use (See page 24).

	Output	Input
IEC 61162-1	DPT DBT	RMA, RMC GLL, VTG ZDA, GGA
NMEA 0183	DBT (Ver.1.5) DBS (Ver.1.5) DBK (Ver. 1.5) DPT (Ver.2.0)	RMA, RMC GLL, VTG ZDA, GGA

ALARM SOUND: Selects audio alarm sound among 1, 2 or 3. Default setting is 1.

1: Continuous sound

2: Intermittent sound; 0.5 s on and 0.5 s off.

3: Intermittent sound; 1 s on and 1 s off.

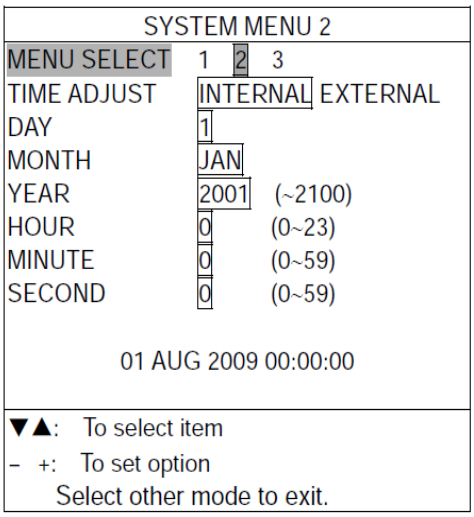
OS DATA: Selects own ship data display mode; DATA 1 or DATA 2. DATA1 is the default setting. If a navigation device is not connected to the FE-700, select DATA 2.

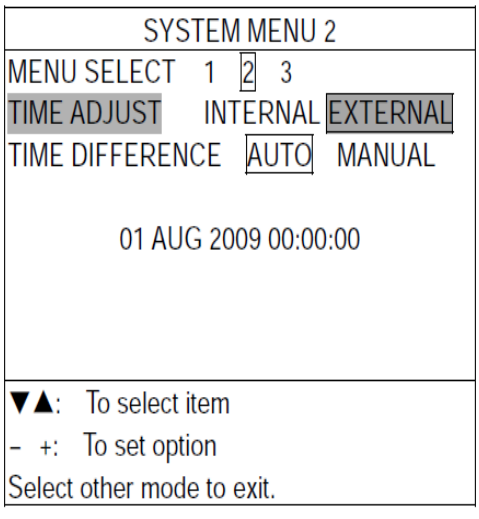
LANGUAGE: Currently English is only available.

ALM BUZZER: When the alarm unit AU-12 is connected, select OFF. Then, the alarm off icon appears. If an alarm occurs, the AU-12 (not FE-700 display unit) sounds alarm.

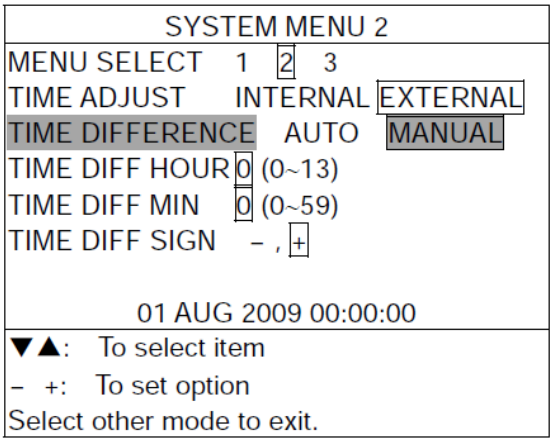
System Menu 2

TIME ADJUST: Selects internal clock or external clock (UTC clock). Default setting is INTERNAL. For INTERNAL, set current day, month, year, hour, minute and second with [+], [-], [▼] or [▲] key. The setting clock appears and it counts upward. If EXTERNAL is selected, the screen changes as follows.




SYSTEM MENU 2
MENU SELECT 1 2 3
TIME ADJUST INTERNAL EXTERNAL
TIME DIFFERENCE AUTO MANUAL
01 AUG 2009 00:00:00
▼▲: To select item
– +: To set option
Select other mode to exit.

TIME DIFFERENCE: Selects auto (UTC) or manual. Auto uses the time difference in ZDA
(IEC 61162-1). In manual, it is necessary to enter the time difference in hours and minutes.


SYSTEM MENU 2
MENU SELECT 1 2 3
TIME ADJUST INTERNAL EXTERNAL
TIME DIFFERENCE AUTO MANUAL
TIME DIFF HOUR 0 (0~13)
TIME DIFF MIN 0 (0~59)
TIME DIFF SIGN - , +
01 AUG 2009 00:00:00
▼▲: To select item
- +: To set option
Select other mode to exit.

System Menu 3

RANGE 1- 8: Activates or deactivates specific range scales. Default ranges are 5, 10, 20, 40, 100, 200, 400, and 800 (meters). Setting area is 2 m to 800 m. The ranges 20 m and 200 m can not be changed. They are essential in this equipment.

Note: Ranges must be set in numerical order. For example, if range 1 is 5 m and range 3 is 20 m, range 2 should be between 6 and 19 m.

Trend: The trend index shows the probable bottom shape over a specified time within 1-10 minutes. The default setting is 1 minute. Set the Trend time with [+] or [-].

ECHO QUALITY SETTING

This chapter describes functions useful for improving echo sounding performance.

Demonstration Display

The demonstration program shows how the FE-700 works.

1. Turn off the equipment.
2. Press the POWER Switch while pressing any key. Release the key when the following

EXTENSION MODE display appears.

EXTENSION MODE	
+ :	TRANSDUCER SETTING
− :	TEST
▲:	CLEAR MEMORY
▼:	DEMONSTRATION

3.Press the [▼] key to select DEMONSTRATION.

DEMONSTRATION	
	OFF ON
−/+:	To set option
▼:	EXTENSION MODE

4. Press the [+] key to select ON.

5. Reset the power. "DEMO" appears above the depth indication on the echo sounder displays and at the top right-hand corner on the data and graphic displays.

 To return to the normal operation, select OFF at step 4 above. Restart the display unit.

Bottom Level

If the depth indication is unstable or the seabed cannot be displayed steadily notwithstanding the adjustment of the control panel, you may adjust the bottom echo level.

⚠ CAUTION

If the level is set too low, the FE-700 may not be able to distinguish the bottom from fish echo and the depth indication may be unstable and if set to high the depth indication does not appear.

1. Press the MUTE ALARM key three times at the EXTENSION MODE. The start-up screen appears and shortly thereafter the BOTTOM LEVEL display appears.

BOTTOM LEVEL		
200kHz	=	80 (20~200)
−+:	200kHz*	

*: Either 200 kHz or 50 kHz is displayed depending on which frequency is used.

2. Set the level with the [+] or [-] key. The default level is 80.

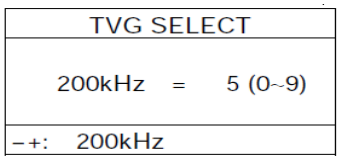
3. Press the POWER switch to finish the adjustment. Wait about 5 s and then turn on the power again.

Note: Do not switch transducer (frequency) at the EX-8 when setting the Bottom Level menu. If it is necessary to set bottom level for a different frequency, turn off the FE-700, switch transducer at EX-8 and then turn on the FE-700 again.

TVG Level

TVG (Time Varied Gain) compensates for propagation attenuation of the ultrasonic waves, reducing surface noise to provide a smooth display. The TVG lowers receiver sensitivity at the time of pulse emission and gradually increases it with time, thereby making objects of same reflectivity at different depths appear at the same intensity or colors on the display. The TVG working depth is down to approximately 150 m on the 200 kHz system and 350 m on the 50 kHz system. Outside this range the echoes from the seabed and fish schools are received in full level. There is no perceivable deterioration in performance.

1. Press the DRAFT key three times at the EXTENSION MODE display. The TVG SELECT window appears.



2. Set the TVG curve with [+] or [-]. The default level is 5. Attenuation compensation curve is at 20LogR curve.

3. Press the POWER switch to finish the adjustment. Wait 5 s, and then turn it on again.

Note: Do not switch transducer (frequency) at the EX-8 when setting the TVG Level menu. If it is necessary to set TVG level for a different frequency, turn off the FE-700, switch transducer at EX-8 and then turn on the FE-700 again.

Echo Offset

The echo offset feature functions to compensate for too weak or too strong echo level. If the onscreen echo level appears to be too weak or too strong and the level cannot be adjusted satisfactorily with the GAIN control, do the following to adjust echo level.

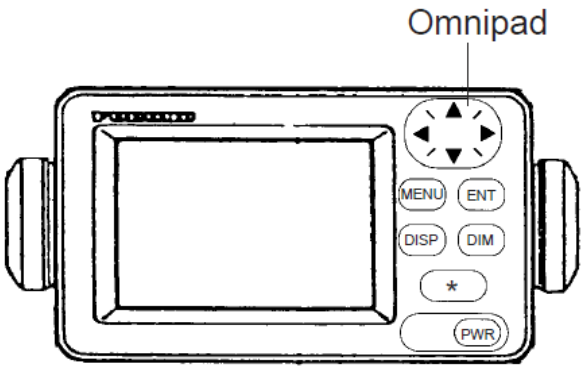
1. Press the DIM key three times at the EXTENSION MODE display. The ECHO OFFSET screen appears.

2. Set the offset with [+] or [-]. The default value is 0.

3. Press the POWER switch to finish the adjustment. Wait about 5 s and then turn it on again.

ECHO OFFSET	
200kHz:	0 (–99~+99)
–+: 200kHz	

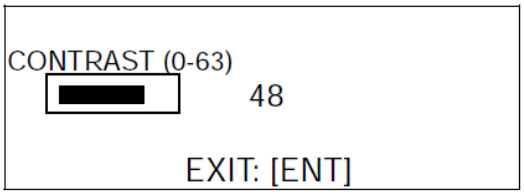
OPERATION OF DIGITAL DEPTH
INDICATOR FE-720 (OPTION)



The Digital Depth Indicator FE-720 is an optional remote display. The panel illumination can be locally adjusted on the control panel or on the optional hand dimmer box.

Basic Operation
Turning on
Press the POWER key. The unit beeps and starts up with the last-used display. To turn off the unit, press the POWER key again.

Adjusting panel dimmer
1. Press the DIM key.
2. Press [ ] to increase the dimmer or [ ] to decrease it. The default is level 4.
3. Press the ENT key to finish the adjustment.
5.1.3 Adjusting Contrast
1. Press the [ ] key. The following window appears.



2. Press [ ] or [ ] until the required value is reached. The range of adjustment is from 0 (Min.) to 63 (Max.). The default is 48.

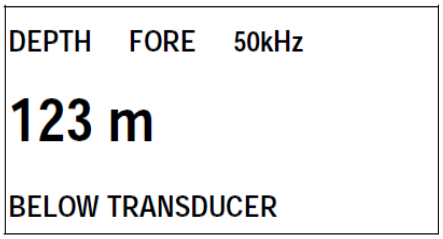
3. Press the ENT key to set.

Note: The contrast is automatically set to the default when you turn on the power.

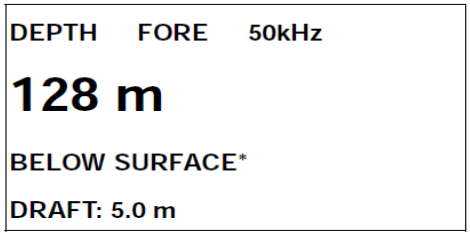
DEPTH MODE

Depths are read either below transducer (keel) or below seaface irrespective of the main display.Select the mode as below:

1. Press the DISP key to select the wanted mode. The mode changes as below with each press.



Depth below transducer



Depth below surface. Draft is determined on the main Display Unit FE-701.

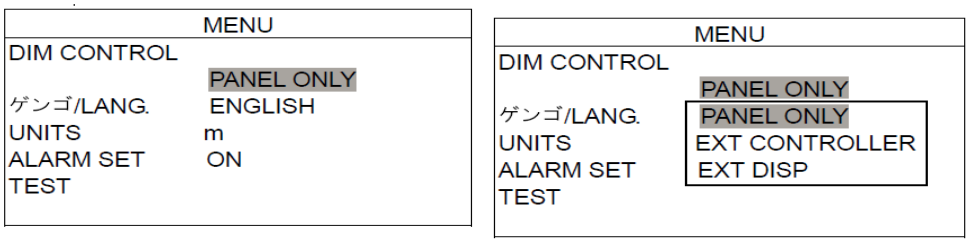
*: If the keel distance is 0.1 to –10.0 (refer to page 8.) BELOW KEEL is displayed instead of the BELOW SURFACE.

Menu Operation

Dimmer control

The dimmer is controlled either with the DIM key, or the optional Dimmer Controller. The method of control must be selected on the menu.

1. Press the MENU key to display the main menu.



2. Press [▲] or [▼] to select DIM CONTROL.

3. Press the ENT key. The following window appears.

4. Press [▲] or [▼] to select option desired.

PANEL ONLY: The illumination of the control panel is adjusted with the DIM key.

EXT CONTROLLER: Illumination of control panel is adjusted with the optional dimmer controller (hand dimmer box). The DIM key is inoperative.

EXT DISP: Not used.

5. Press the ENT key to set.

6. Press the MENU key to finish.

Selecting language

The language in use on the screen is either English or Japanese.

1. Press the MENU key to display main menu.

2. Press [▲] or [▼] to select the /LANG.

3. Press the ENT key. The following window appears.

4. Press [▲] or [▼] to select appropriate option. The default is English.

5. Press the ENT key to set.

6. Press the MENU key to finish.

Selecting the unit of depth measurement

The unit of depth measurement is separately selected from the Main Display FE-701.

1. Press the MENU key to display main menu.

2. Press [▲] or [▼] to select the UNITS.

3. Press the ENT key. The following window appears.

4. Press [▲] or [▼] to select unit. The default is meter (m).

5. Press the ENT key to set.

6. Press the MENU key to finish.

Alarm

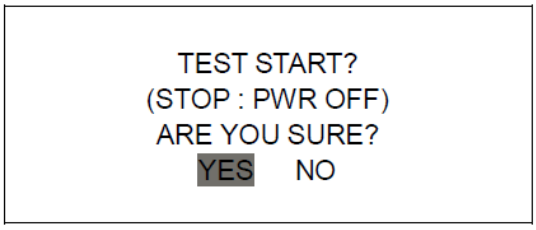
You can set turn alarm on or off. In the ON mode,if the main display unit activates the alarm, the FE-720 also.

1. Press the MENU key to display main menu.
2. Press [▲] or [▼] to select ALARM.
3. Press the ENT key. The following window appears.
4. Press [▲] or [▼] to select appropriate option. The default is ON.
5. Press the ENT key to set.
6. Press the MENU key to finish.If the alarm sounds, press any key to silence it.

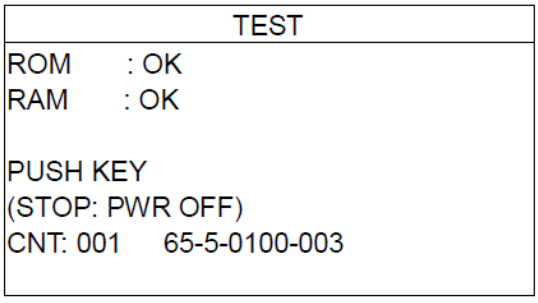
Diagnosis

The diagnostic test checks ROM, RAM, keys and LCD of the FE-720.

1. Press the MENU key to display main menu.
2. Press [▲] or [▼] to select TEST.
3. Press the ENT key. The following window appears.



4. With YES selected, press the ENT key to start the test. The equipment tests the ROM and RAM, displaying the results as OK or NG (No Good). If NG appears, contact your dealer for advice.

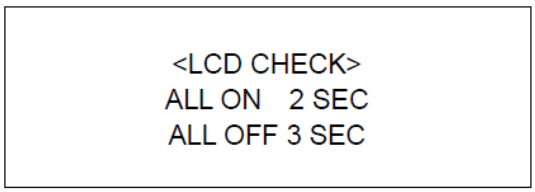


5. After "PUSH KEY" is displayed, press each key one by one. The name of the key pressed momentarily appears if the key is functioning properly.

The display shows the following message to inform you that the program is now going to check the LCD.

The whole display brightens for 2 seconds then turns off for 3 seconds. Test repeats. CNT, which is number of times the test has been consecutively executed, is counted up.

6. To stop the test, turn off the power.

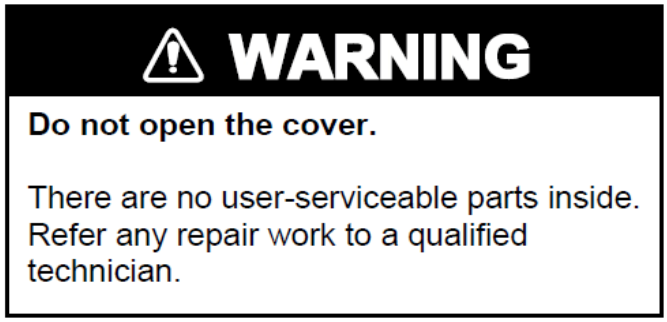


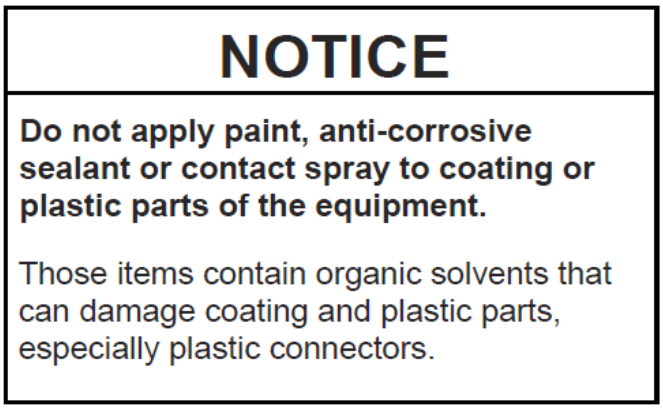
Factory Setting

You can restore default settings to start operation anew. Press the POWER switch while pressing [▲]. The message "RESET BACKUP DATA!" appears. After a while, all default settings are restored and the depth indication appears.

3.4 Maintenance

MAINTENANCE,TROUBLESHOOTING


⚠ WARNING
Do not open the cover.
There are no user-serviceable parts inside. Refer any repair work to a qualified technician.


NOTICE
Do not apply paint, anti-corrosive sealant or contact spray to coating or plastic parts of the equipment.
Those items contain organic solvents that can damage coating and plastic parts, especially plastic connectors.

Checking

Regular maintenance is essential for good performance. Checking the items listed in the

table below on a regular basis will keep the equipment in good shape for years to come.

Item	Action
Cable run	If conductors are exposed, replace cable.
Power cable, transducer cable plug	If loosened, tighten.
Display unit ground	If corroded, clean.
Ship's mains voltage	If out of rating, correct problem.

Cleaning the Display Unit

Dust or dirt on the display unit should be removed with a soft cloth. If desired a water-moistened cloth may be used. Do not use chemical cleaners; they can remove paint and markings.

Transducer Maintenance

Marine life on the transducer face will result in a gradual decrease in sensitivity. Check the transducer face for cleanliness each time the ship is dry-docked. Carefully remove any marine life with a piece of wood or fine-grade sandpaper.

Replacing the Fuse, Battery

If a fuse blows, find the cause before replacing it. Use only designated fuses. Using the wrong fuse will damage the unit and void the warranty.

Three types of fuses are used in the distribution box FE-702.

For Display Unit : 3 A x 1 pc (24 VDC)

For Digital Depth Indicator: 0.5 A x 2 pcs

For AC input: 1 A x 2 pcs

The Digital Depth Indicator FE-720 uses one fuse of 1 A, which is inserted in the positive line of interconnection cable.

A battery installed on a circuit board inside the display unit preserves data when the

power is turned off. The life of the battery is about three years. When the battery voltage is low, “battery” NG appears at the self-test. When this happens, contact your dealer to request replacement of the battery.

	TYPE	Code Number
Lithium Battery	CR2450-F2 ST2	000-133-495

Troubleshooting

The table below provides simple troubleshooting procedures which you may follow to restore normal operation. If you cannot restore normal operation, contact your dealer

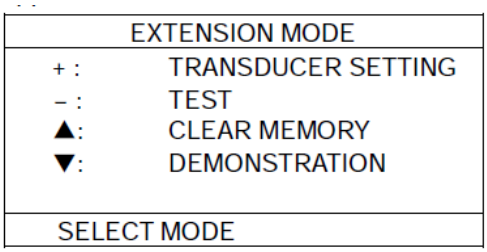
SYMPTOM	PROBABLE CAUSES	REMEDY
No picture; no reading measure	Low power supply	Check the supply voltage.
	Fuse blown	Replace the fuse.
	Power cable damaged	Check the cable and repair.
No echo sounding picture	Transducer cable damaged	Repair the cable.
	Transducer cable connection loosened	Tighten the connections.
	Transmitter not working	Make sure the maximum output power is selected. (See section 3.2 System Menu 1.)
Irregular display	Low sensitivity	Increase the Gain by turning the GAIN control clockwise.
	Low reflectivity from seabed	Suspect muddy seabed.
	Marine life on transducer	Remove marine life from the transducer when dry docked.
Loss of seabed display	Out of range	Check the range scale setting.
	Air bubbles caused by going astern or running over other ship wakes	This is normal, it is not a sign of equipment trouble.
Heavy noise	Wrong installation place of transducer	Find cause of noise. Relocate the transducer if noise persists.
	Other echo sounders nearby	If more than one echo sounder is working on the ship, there is no ideal measure to cure the problem.
Surface noise	Aeration in near surface area	Not an equipment problem.
	Rough weather	Not an equipment problem.

Diagnostic Test

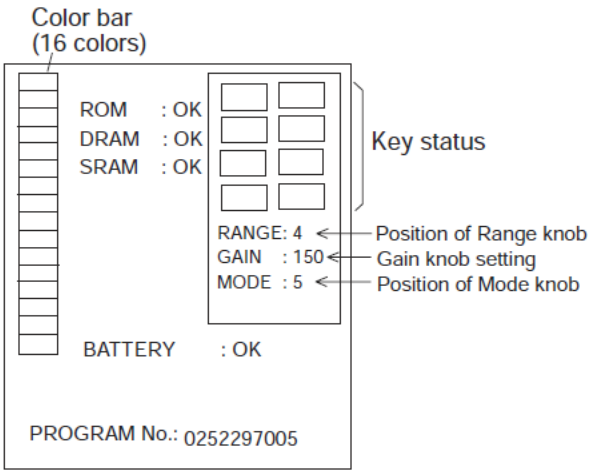
The diagnostic test checks the ROM, RAM, color bar and keyboard for proper operation.

1. Turn on the power while pressing any key. Release the keys when the following display

appears.



Press the [-] key.



3. The ROM, DRAM, SRAM and internal battery are checked and the results are displayed as OK or NG (No Good). If NG appears, contact your dealer for advice.

4. Press and release each key (except the POWER switch) one by one. If the key is normal, its on-screen location lights in black while the key is pressed.

5. Operate the controls. The RANGE and MODE control setting indications should be the same as actual control settings. The GAIN control setting indication should be between 0 and more than 230.

6. Press the POWER SWITCH to finish. Turn on the power again to resume operation.

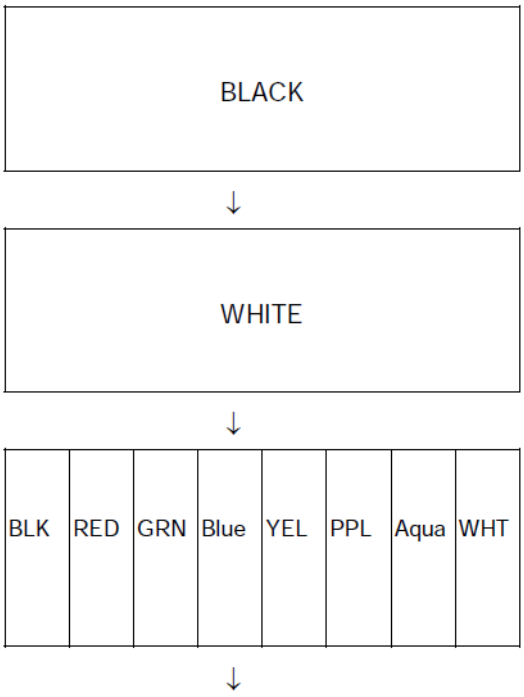
Test Pattern

The test pattern is used to check color performance.

1. Turn on the POWER SWITCH while pressing any key.

2. Press the BRILL key three times. Press the BRILL key again to change the test pattern as below.

Press the BRILL key again to return to the EXTENSION MODE menu.



Clearing the Memory

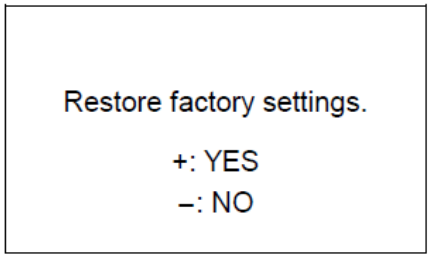
All menu settings can be cleared to start afresh.

All default menu settings are restored when the memory is cleared. For your reference all default settings are shown in the menu tree at the end of this manual.

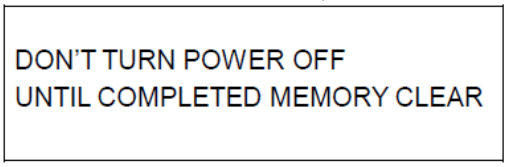
1. Turn on the power while pressing any key. Release the keys when the EXTENSION

MODE menu appears.

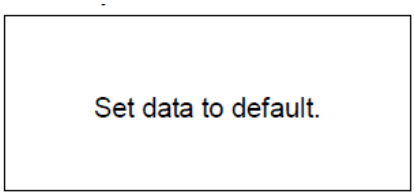
Press the [▲] key. The following window appears.



Press the [+] key to clear the memory. The following window appears.



Then the following display appears after the memory is cleared.



4. After data is cleared, the EXTENSION MODE menu appears.

Note: The setting for the items LANGUAGE and TRANSDUCER in the system menu is not disturbed when the memory is cleared.

IV Speedlog

1 EML224

1.1 System overview

The SKIPPER EML224 is a navigational electromagnetic log system containing sensor (transducer), display (operator) unit and an electronic interconnection unit. The sensor can be delivered in many different versions to fit functionality demands and different hull installations. The display unit can be a larger unit with a high resolution LCD, or a smaller unit with dot-matrix LEDs. This manual only cover the version with the LCD unit.

The LCD can display a number of parameter in both numerical and graphic forms. The information from the electromagnetic sensor includes longitudinal and transversal speeds, drift angle and sea temperature. It is thus possible to get a very good picture of the vessels total movements.

The EML224 electromagnetic log will give direction of speed in both axis (ahead/astern and starboard/ port). This is of great importance during manoeuvring or when running at low speeds. The speed range is the same astern and ahead. The user may select display text languages as well as various units of measure. All IMO requirements are met or exceeded. Comprehensive interfaces are available including NMEA 0183 input and output.

1.2 Technical data

Dimensions

Sensor		
	Cable length	40 m.
	Mounting	Sea valve or tank.
Electronic Unit	H x W x L mm.	120 x 300 x300
	Weight	ca. 6 kg

Operator unit cabinet	Height, front .	340 mm
	Width	320 mm.
	Depth	170 mm.
	Weight	ca. 10 kg
Operator Unit Cabinet,		
Cut-out for flush mounting	H x W	322 x 302 mm.
Corner radius	**4 mm**	

Functional Properties

Trip counter	Measurement from 0 to 99 999.99 nautical miles.
Distance accuracy	0.2 nm or 2 % whichever is greater.
Speed accuracy	0.2 Kn or 2 % whichever is greater.
Speed range	+/- 40 Kn.
Rolling	More than +/- 10 degrees.
Pitching	More than +/- 5 degrees.

The performance will depend on turbulence, aeration and sea conditions. These effects may lead to occasional incorrect indication of speed and distance. Speed measurement is done directly on the sensor surface, comply with IMO Res. A.824/A1.1

Environmental according to IEC60945

Operator/Display Unit		
	AC Supply voltage	230 V(195 - 253 V AC) or 115 V(96 - 125 V AC).
	DC supply voltage	24V DC (20-32 V)
	Power consumption	50 W at 24 V, 70 W at 230 V or 115 V.
	Alarm relay	Change-over contact, max.24V300 mA.
	NMEA port	9 pin D-type. 2 inputs, 2 outputs.
	Operating temperature	-15-55 degree C. To increase serviceability and lifetime, we

		suggest the working temperature to be held at 0 - 40 degrees C.
	Storage: temperature	-20 - 70 degree C.
	Humidity	10-90% relative, no condensation
	Protection	IP 23.
Electronic Unit		
	AC Supply voltage	230 V(195 - 253 V AC) or 115 V(96 - 125 V AC).
	DC supply voltage	24V DC (20-32 V).
	Operating temperature	-15 - 55 degree C. To increase serviceability and lifetime, we suggest the working temperature to be held at 0 - 40 degrees C.
	Storage temperature	-20 - 70 degree C.
	Protection	IP33
Transducer (sensor)		
	Operating temperature	-15 - 55 degree C.
	Storage temperature	-20 - 70 degree C.
	Protection	Submerged, 6 bar

1.3 Operation

When the installation is complete, and power is connected to the operator unit, the system is switched on by pressing any button. The unit is switched off by pressing the "SYSTEM off" softkey on screen A and screen B.

Parameter entry

The fixed function buttons and the softkey(s) on the various screens along with the rotating encoder, facilitates entry of parameters, setpoints and other data. The following flowchart illustrates the procedure for changing settings and entering data. The various screens are shown in detail in the operation section.

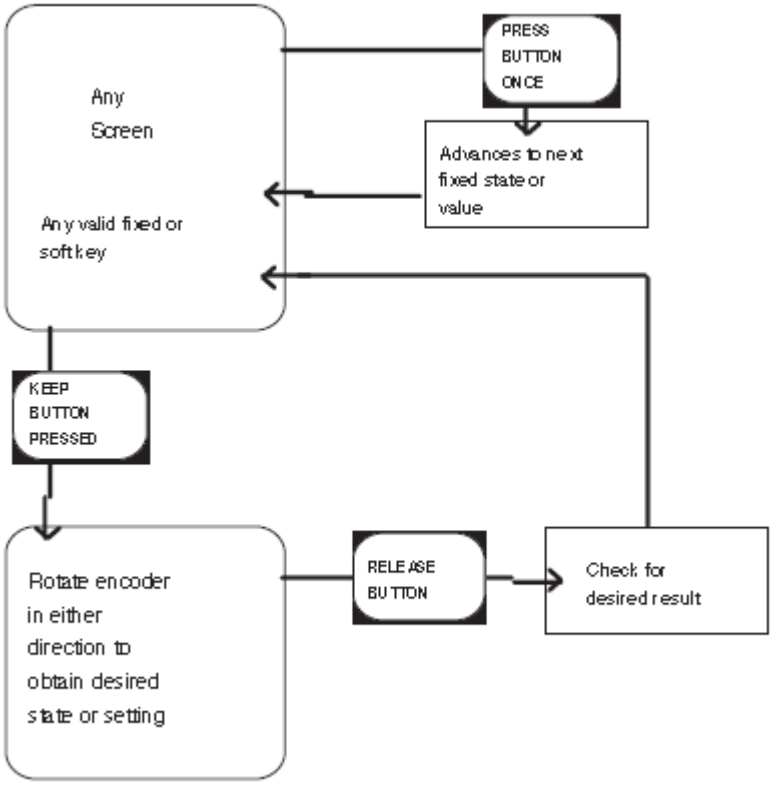


Fig. 3.1 Setting and Parameter Entry Flowchart

Example of parameter entry.

Suppose you want to enter a value of 15 kts for the high speed alarm. Press a high speed alarm softkey, e.g. in screen status, menu 1, and keep it pressed while you turn the encoder until you reach 15 kts, let go of the encoder and release the high speed alarm button.

Buttons with less than 6 possible states or values can be operated without using the encoder at all.

Operation Screens

Each of the operation screens contains a graphic picture and one or more menu sets configured on the 6 softkey buttons. The various screens are selected by keeping the SCREEN SELECT button pressed and rotating the encoder in either direction. Turning the encoder clockwise cycle the screens in the sequence 1 to 5, and counter clockwise rotation cycles the screens in the sequence 5 to1. Screens A and B, covering the primary functions, may also be cycled by repeatedly pressing the SCREEN SELECT button. Screen COM, STATUS and CALIBRATION is mainly

used for setup and function control, and may only be accessed by the rotating encoder.

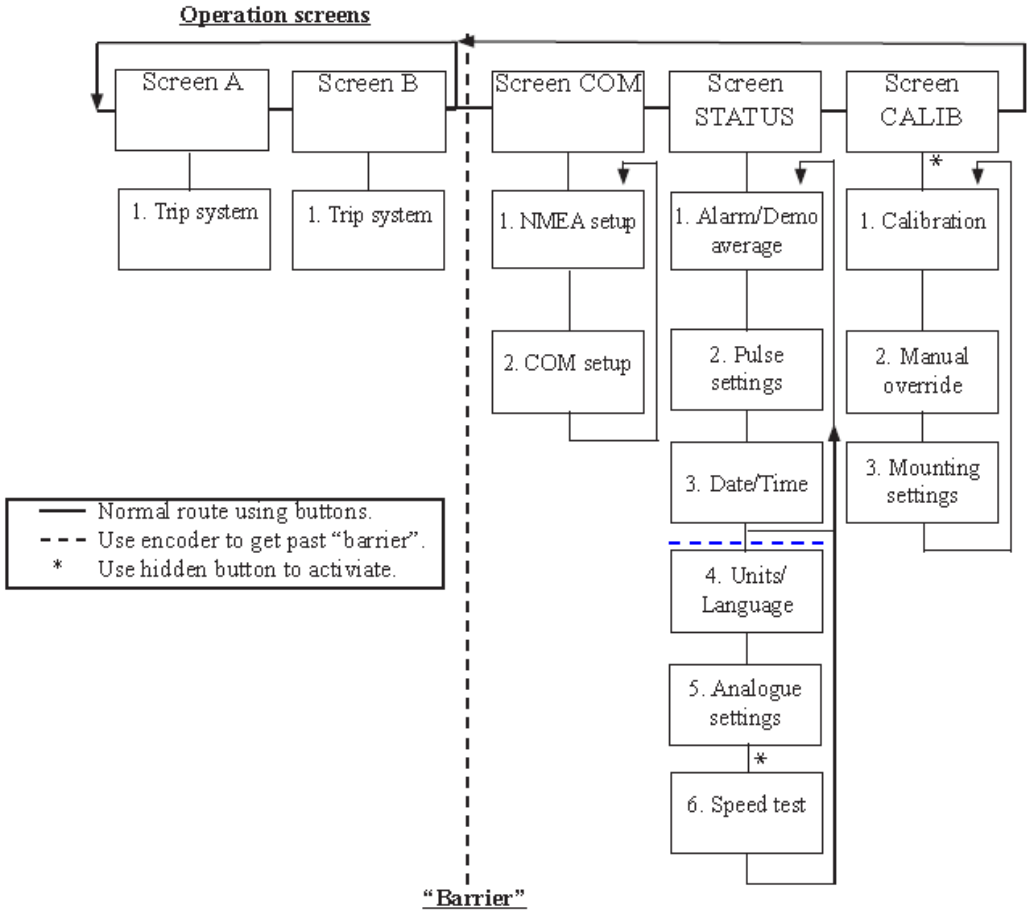


Fig. 3.2. Schematic overview of screens and softkey menus

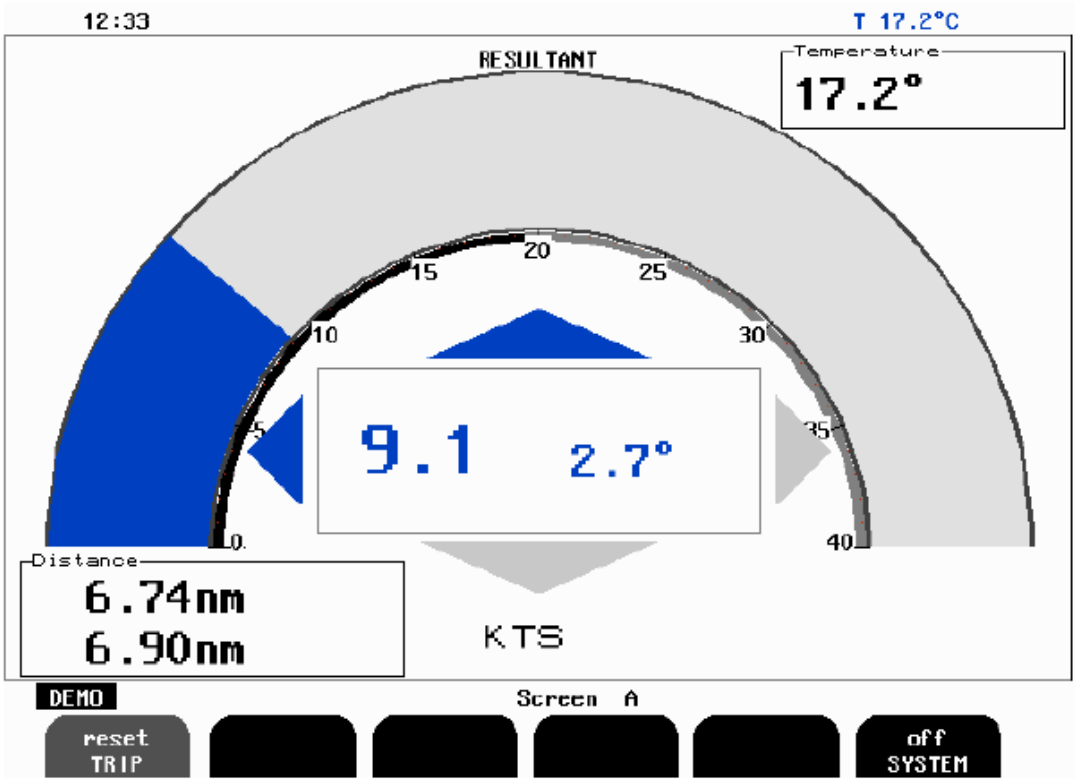


Fig. 2.3. Screen A

Softkey	Name	Range/value	Default value	Description
1	TRIP	Reset		Trip distance counter reset.
2				Not used.
3				Not used.
4				Not used.
5				Not used.
6	SYSTEM	On/off	On	System off.

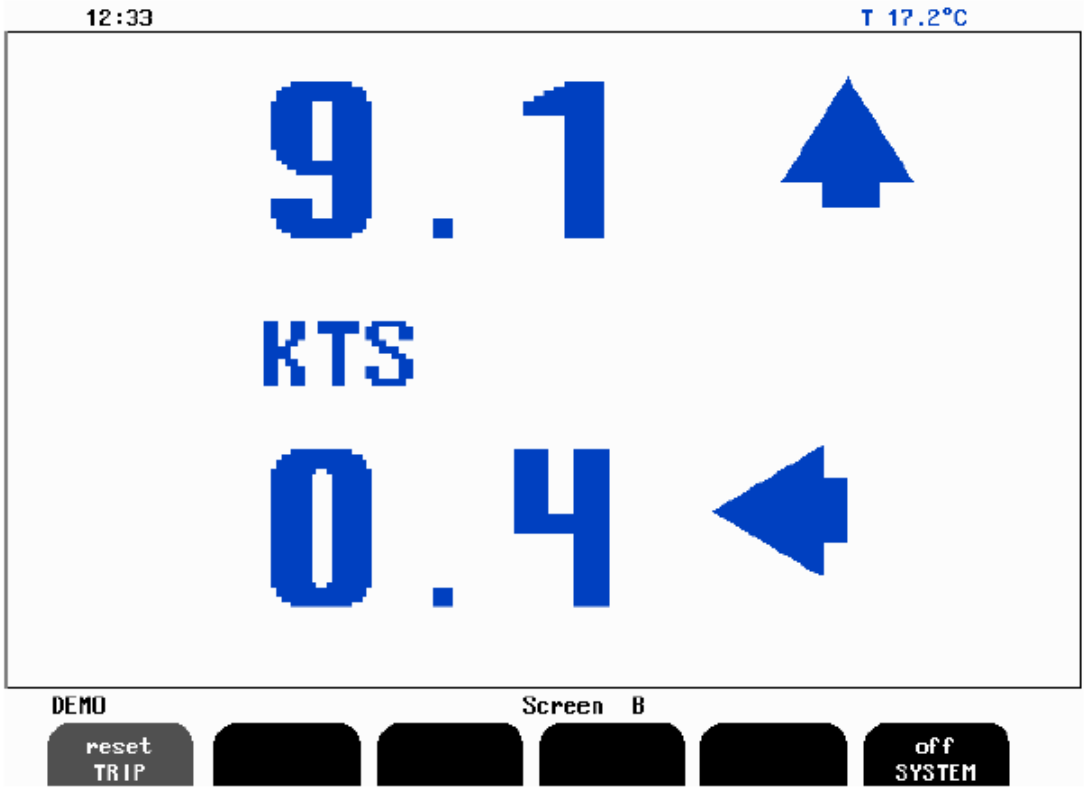


Fig. 3.4. Screen B

Softkey	Name	Range/value	Default value	Description
1	TRIP	Reset	Reset	Trip distance counter reset.
2				Not used.
3				Not used.
4				Not used.
5				Not used.
6	SYSTEM	On/off	On	System off.

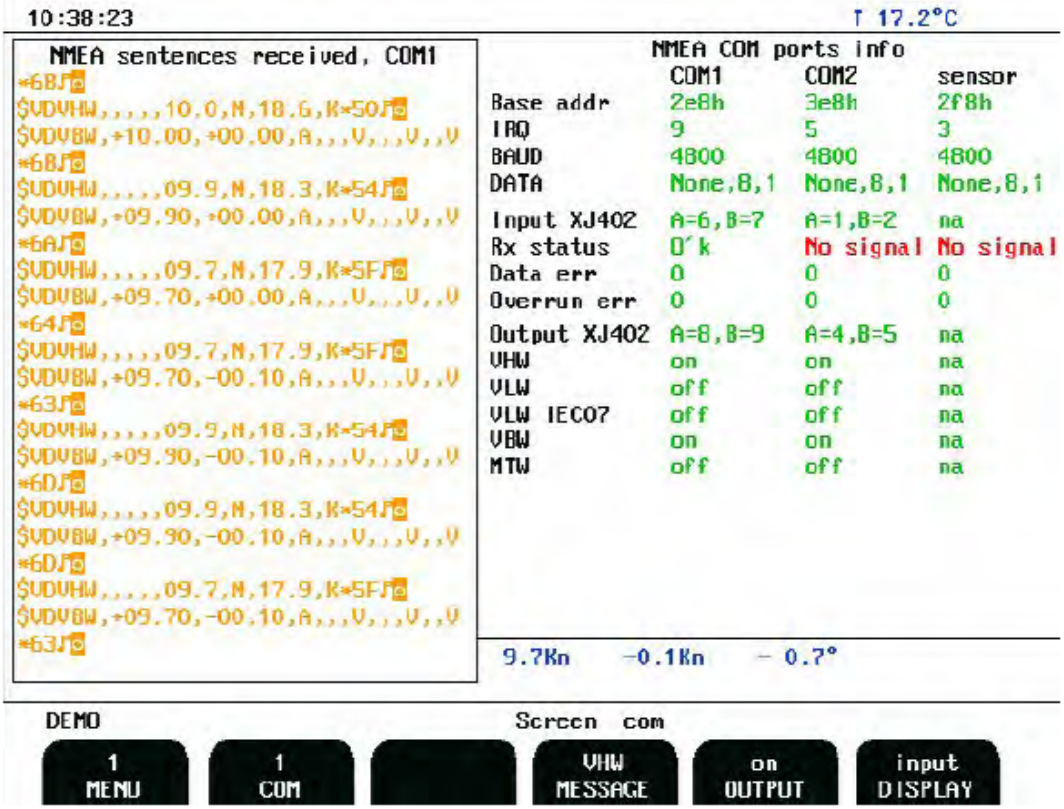


Fig. 3.5 A. Screen Com, Menu 1

Softkey	Name	Range/value	Default value	Description
1	MENU	1-2	1	**Chosen menu number 1.**
2	COM	1-2	1	**Serial port number referred by other keys.**
3				**Not used.**
4	**MESSAGE**	**VHW, VLW, VLW IEC07, VBW, MTW**		**NMEA message selector. Each message may be controlled individually by softkey 5.**
5	**OUTPUT**	**On/off**	**VHW: on VLW: off VLW IEC07: off VBW: on**	**Setting for the message in softkey 4 [On/Off] Note: To configure the serial output of the system, go through all the messages by pressing**

			MTW: off	**soft key 4 and set on/off value of the softkey 5 to disable/enable a message as required.**
6	**DISPLAY**	**Input, off, output**	**Output**	**Selects the information (received from the external source or transmitted by the EML224) to be displayed in the "TEXT" window.** **•Input: Displays information received from external source.** **Output: Displays information transmitted by EML224.** **• Off: None.**

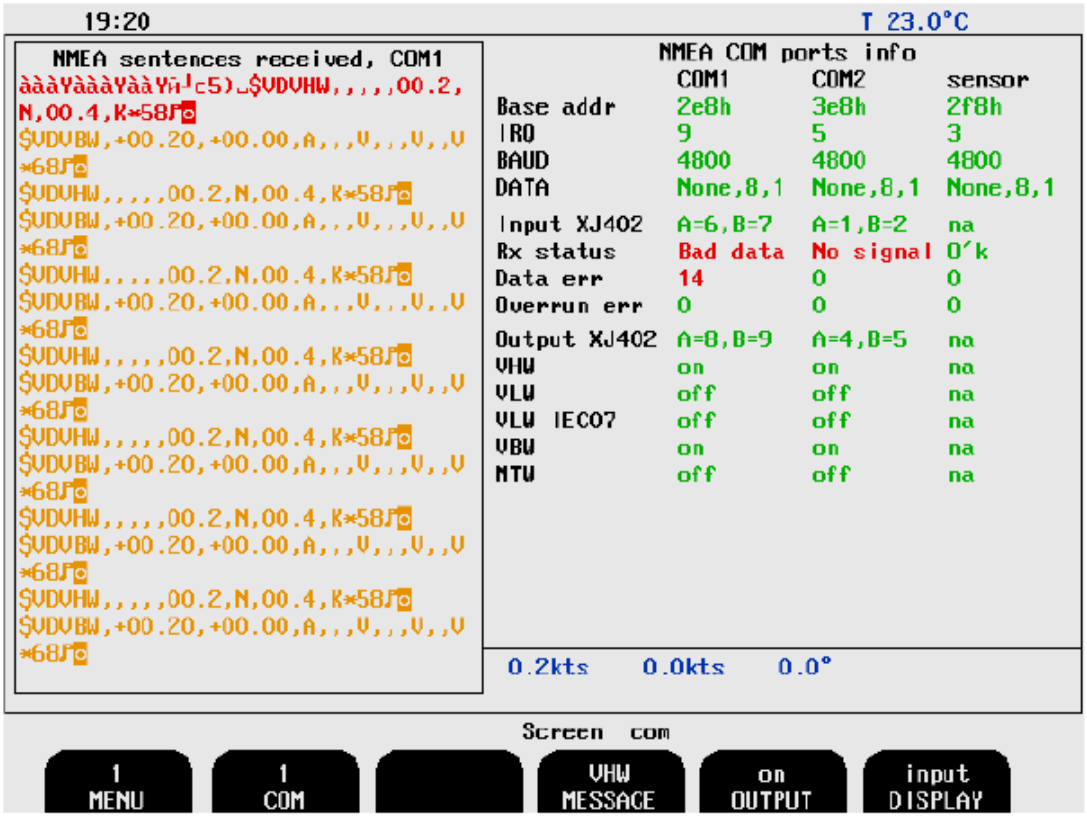


Fig. 3.5 B. Screen Com, Menu 1 Error/Warning messages

The right side of the screen shows the status of the available COM ports and the

sensor. Showing in green which pins the ports are connected to on D-SUB type connector XJ402. Active NMEA protocols are also shown. The text window on the right side, when set to input DISPLAY, indicates what is being received and recognised by the unit.

• Accepted messages are shown in black type if the sentence is correct.

• Not of a recognised format, the text is orange

• If something is wrong with the sentence, such as format or checksum, the text is in red.

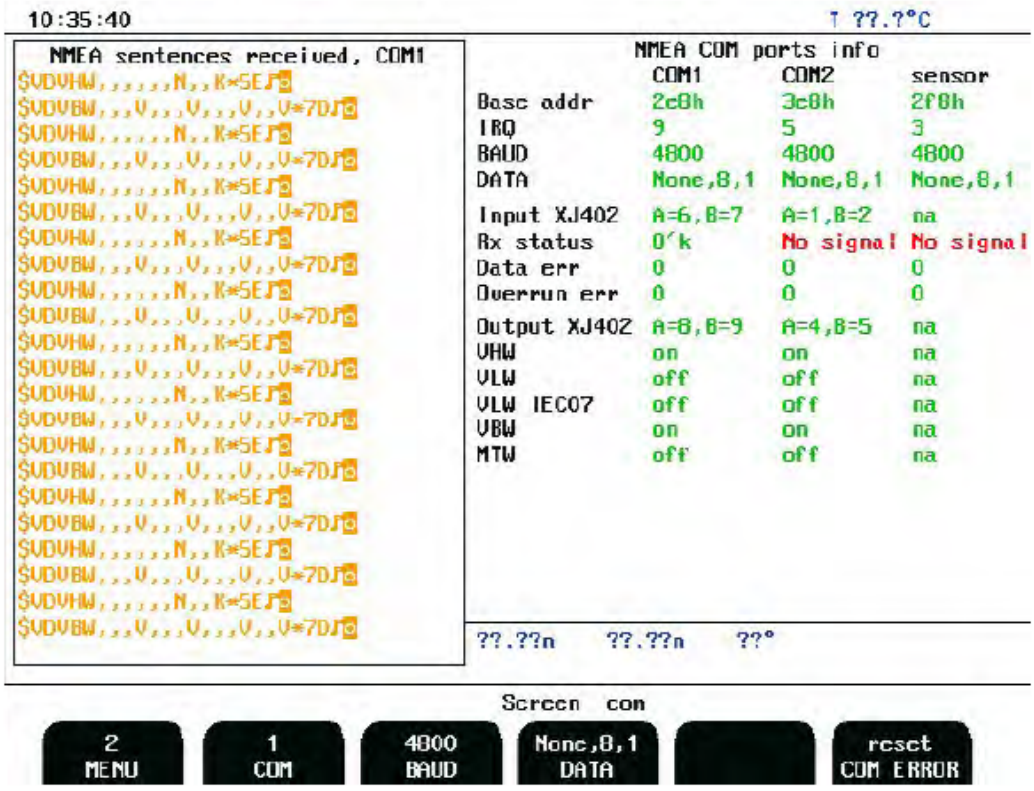


Fig. 3.6. Screen Com, Menu 2

Softkey	Name	Range/value	Default value	Description
1	MENU	1-2	2	**Chosen menu number 2.**
2	COM	**1 - 2, Sensor**	1	**Serial port number referred by other keys.**
3	BAUD	**1200, 2400, 4800, 9600, 19200, 38400, 56700,**	4800	**Baudrate for COM port #n.**

		115200.		
4	**DATA**	**None-7-1, Even-7-1, Odd-7-1, None-8-1, Even-8-1, Odd-8-1, None-7-2, Even-7-2, Odd-7-2, None-8-2, Even-8-2, Odd-8-2,**		**Data format for COM port #n (Parity-data bits-stop bits).**
5				**Not used.**
6	**COM ERROR**	**Reset**		**The program memorizes the latest occurred NMEA input error for further analysis (error code presented on the status and com screens). By using this softkey, it is possible to reset the error.**

Note: BAUD and DATA appear dimmed when softkey 2 COM is in “Sensor” mode.

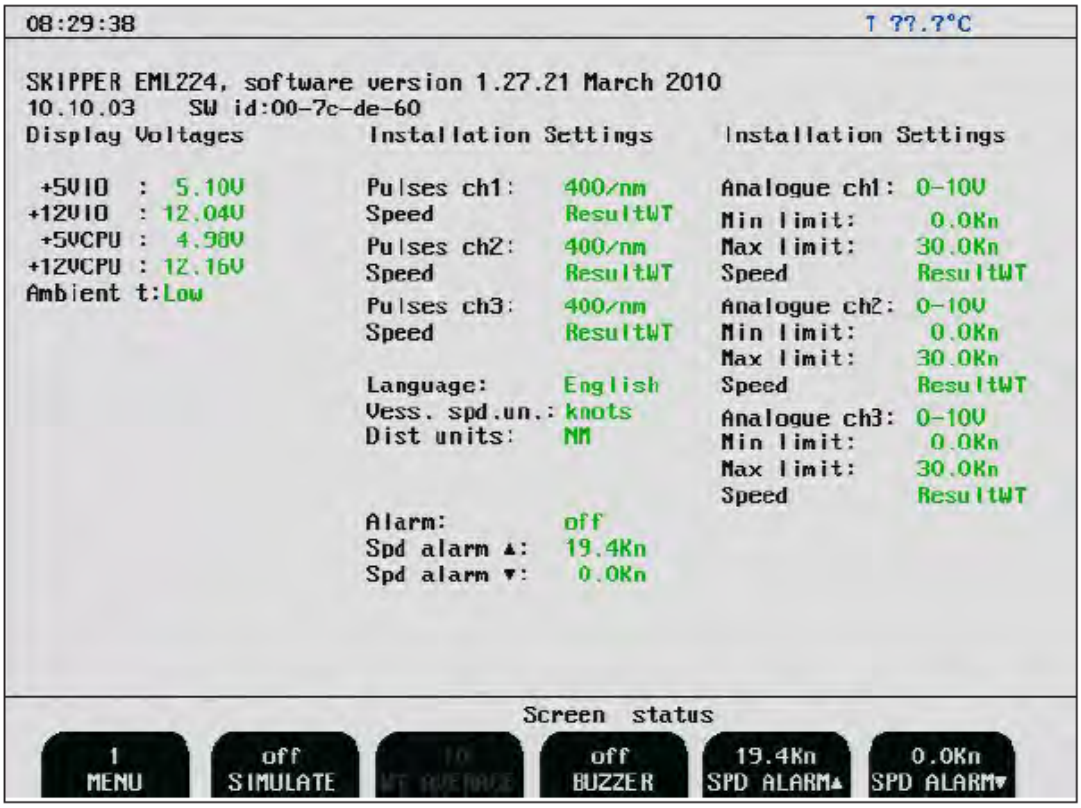


Fig. 3.7. Screen Status, Menu 1

Softkey	Name	Range/value	Default value	Description	Activate with hidden button
1	MENU	1-6	1	**Chosen menu number 1.**	
2	**SIMULATE**	**On/off**	Off	**Built-in simulator on/off.**	
3	**WT AVERAGE**	**0 - 100**	10	**Number of individual samples to be averaged in water track mode to provide better accuracy.**	Yes
4	**BUZZER**	**On/off**	Off	**Buzzer alarm on/off.**	
5	**SPD ALARM ▲**	**0.1 - 38.9 Kn**	**19.4 Kn**	**High speed alarm.**	
6	**SPD ALARM**	**0.0 - 38.8**	**0.0 Kn**	**Low speed alarm .**	

	▼				

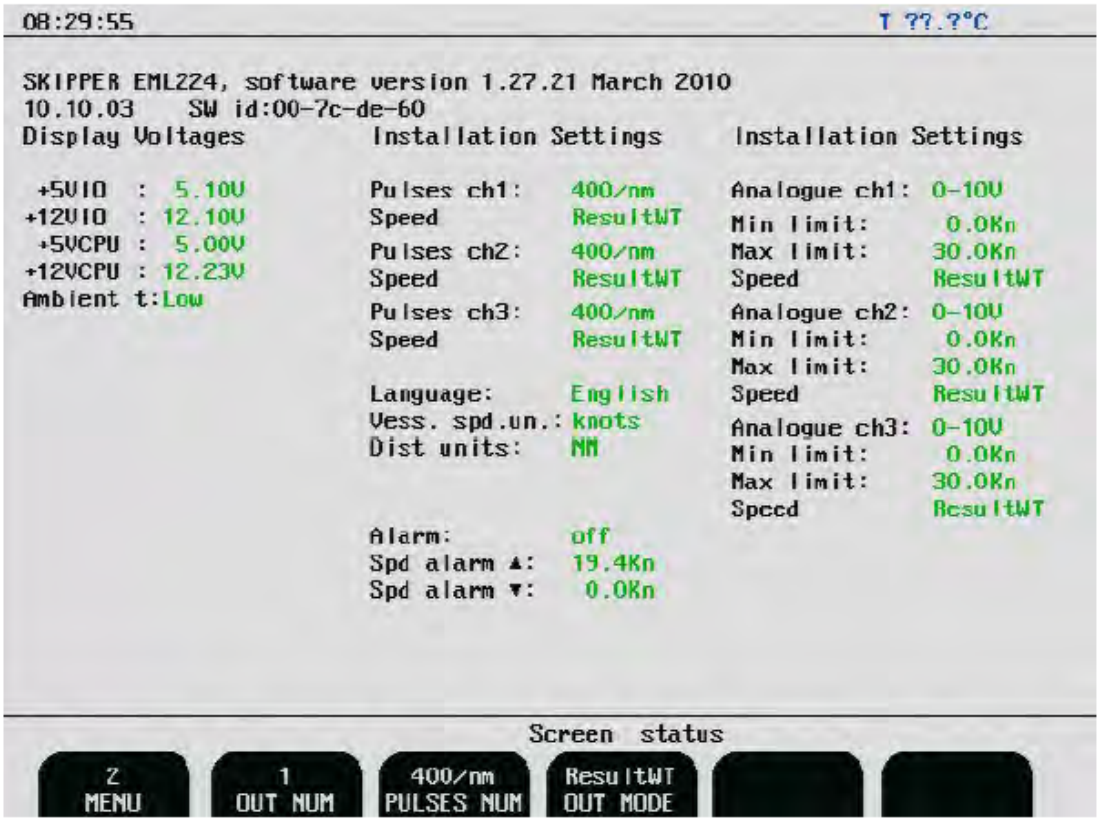


Fig. 3.8. Screen Status, Menu 2

Softkey	Name	Range/value	Default value	Description
1	MENU	1-6	2	**Chosen menu number 2.**
2	**OUT NUM**	1-3	1	**Pulse output channel to be configured by keys 3 and 4.**
3	**PULSES NUM**	**10, 100, 200, 400, (1000)/nm**	**400/nm**	**Number of pulses per nautical mile at this channel (key 2). Channel 1 and 2 are programmable with 10, 100, 200 and 400 pulses per nautical mile. Channel 3 are programmable with 10, 100, 200, 400 and 1000 pulses per nautical mile.**
4	**OUT MODE**	**ResultWT, ForAftWT,**	**ResultWT**	**Speed parameter to be output at this channel (key 2).**

		LateralWT ,		
5				**Not used**.
6				**Not used**

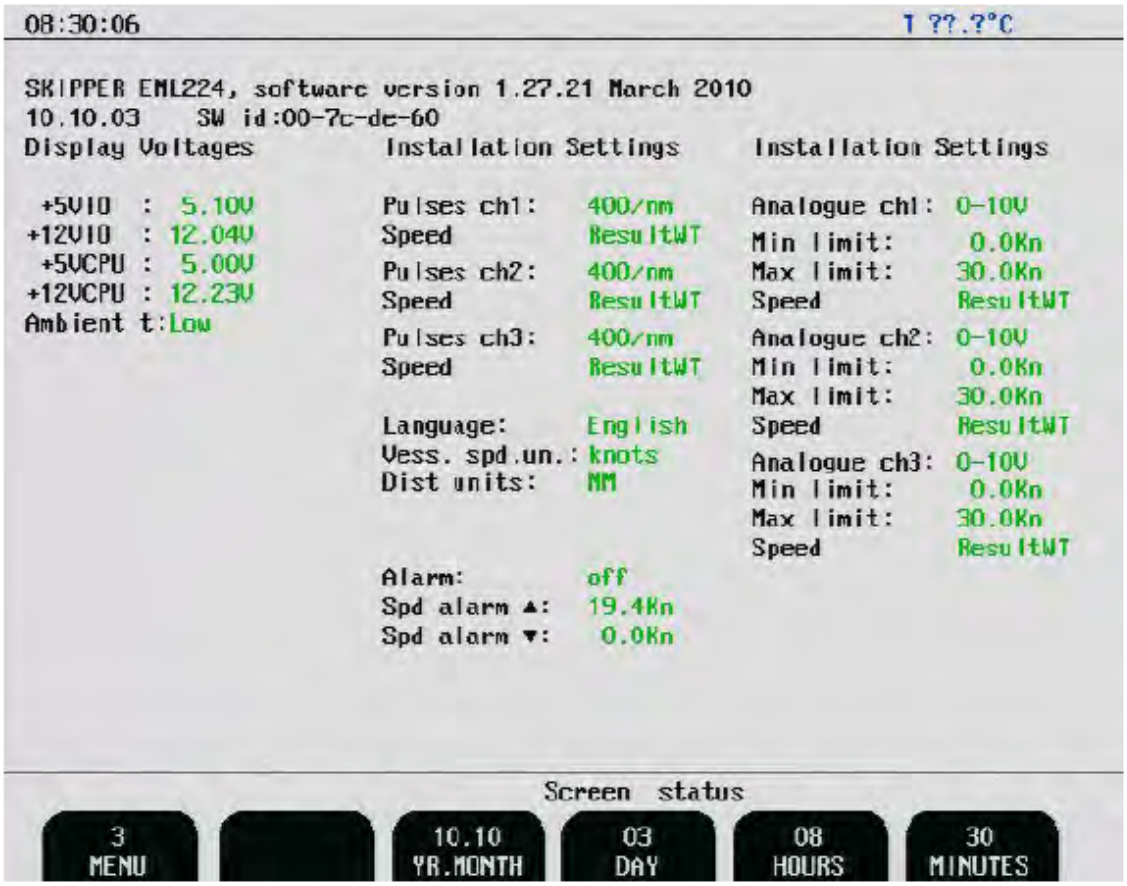


Fig. 3.9 Screen Status, Menu 3

Softkey	**Name**	**Range/value**	**Default value**	**Description**
1	MENU	1-6	3	**Chosen menu number 3.**
2				**Not used.**
3	**YR.MONTH**			**Year and month setting.**
4	**DAY**			**Date setting.**
5	HOURS			**Hours setting.**
6	MINUTES			**Minutes setting.**

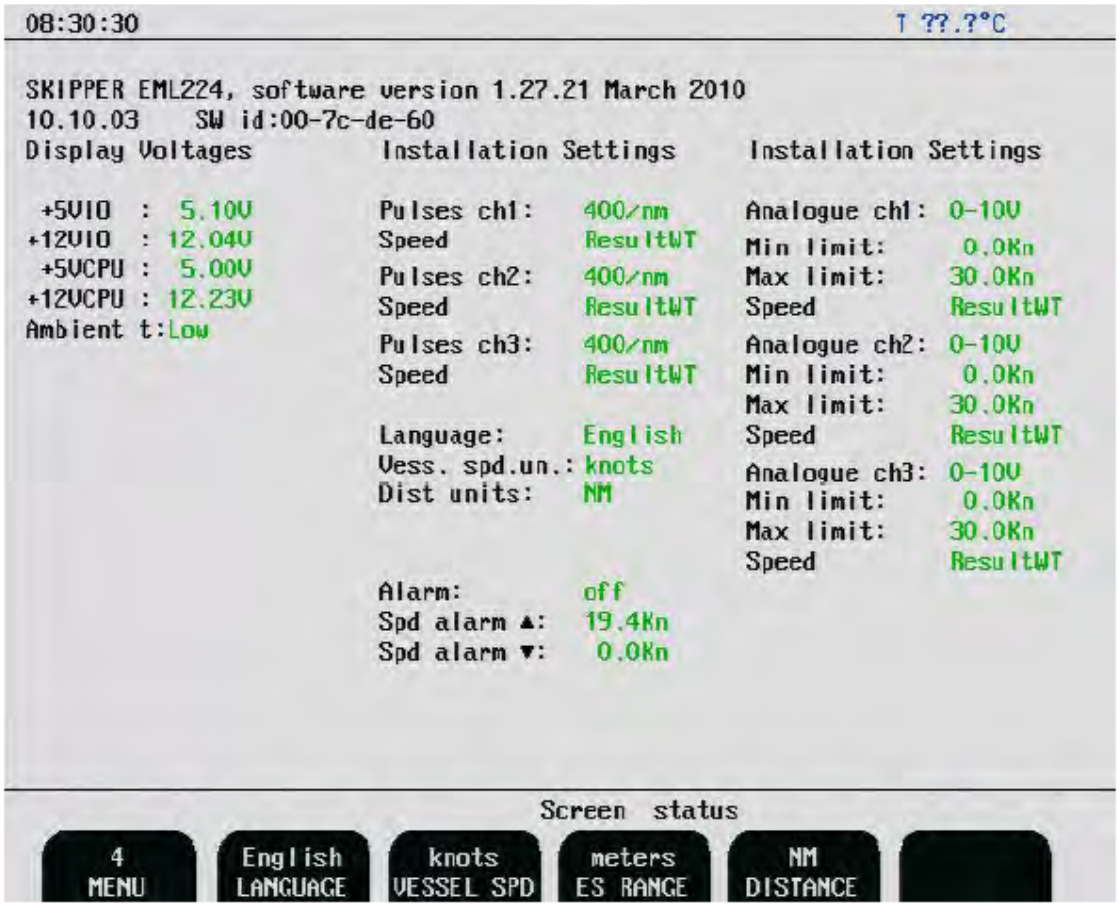


Fig. 3.10. Screen Status, Menu 4

Softkey	Name	Range/value	Default value	Description
1	MENU	1-6	4	**Chosen menu number 4**
2	**LANGUAGE**	**English, French, Spanish, Russian, German, Scandinavian.**	**English**	**Select display language.**
3	**VESSEL SPD**	**Knots, km/h, mi/h, m/sec.**	**Knots**	**Select speed unit.**
4	**ES RANGE**	**Meters, feet, fathoms, braccias.**	**Meters**	**Select depth unit.**
5	**DISTANCE**	**NM, km, mi.**	**NM**	**Select distance unit.**
6				**Not used.**

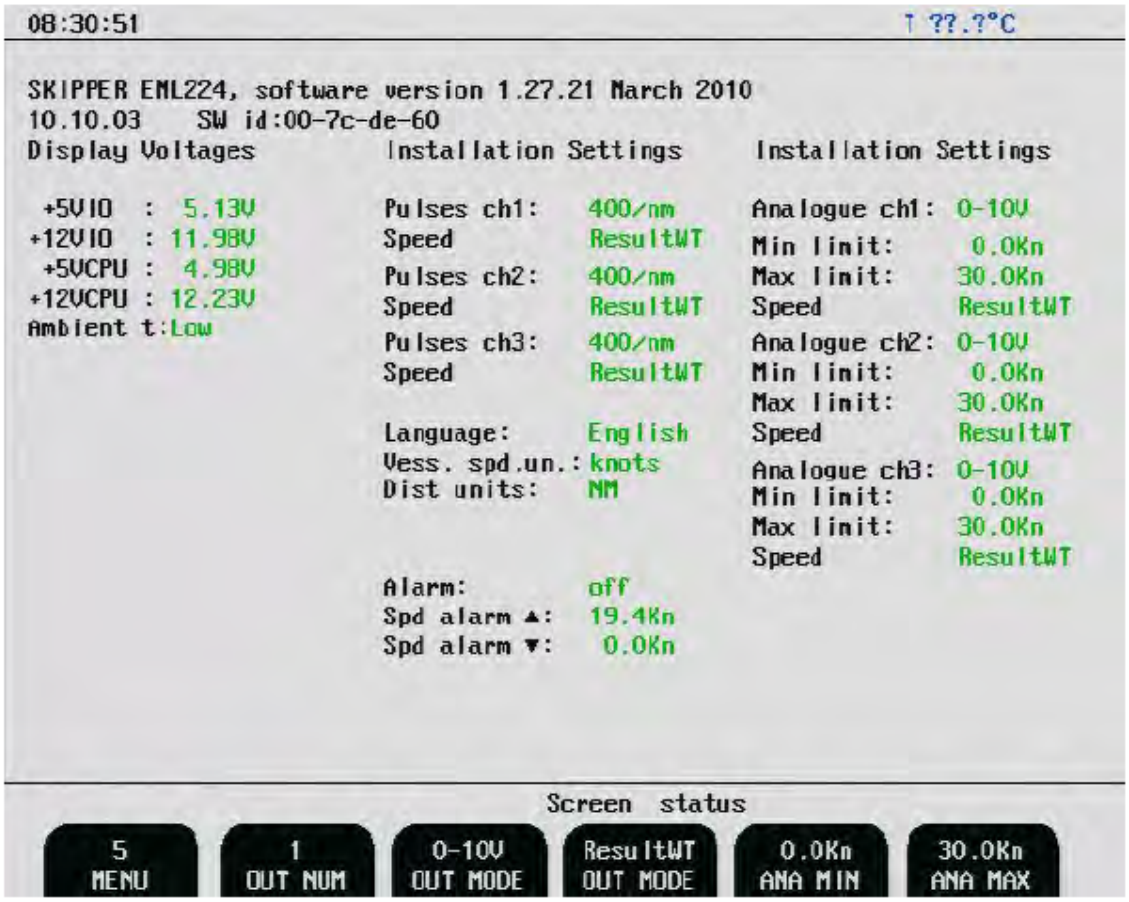


Fig. 3.11. Screen Status, Menu 5

Softkey	Name	Range/value	Default value	Description
1	MENU	1-6	**5**	**Chosen menu number 5.**
2	**OUT NUM**	**1 - 3**	**1**	**Analogue output channel to be configured by keys 3 - 6.**
3	**OUT MODE**	**0 - 10 V** **4 - 20 mA**	**0 - 10 V**	**Output mode selection for this channel (key 2).**
4	**OUT MODE**	**ForAftWT, Lateral/WT, ResultWT**	**ResultWT**	**Speed Parameter to be output at this channel (key 2).**
5	**ANA MIN**	**-48.6 - 48.6 Kn**	**0.0 Kn**	**Speed value for minimum output at this channel (key 2).**
6	**ANA MAX**	**-48.6 - 48.6 Kn**	**30.0 Kn**	**Speed value for maximum output at this channel (key 2).**

Fig.3.12. Screen Status, Menu 6

Functions described below can be used during commissioning period to test different outputs with constant, user adjustable speed values. Note: When the test mode is activated, this will be indicated by flashing “TEST” label in the lower left part of the screen.

Softkey	**Name**	**Range/value**	**Default value**	**Description**	**Activate**
1	MENU	1-6	**5**	**Chosen menu number 5.**	
2	**SPD TEST**	**On/off**	**Off**	**Toggling test mode on/off.**	**Yes**
3	**LONG. SP**	**-40.0, -20.0, -15.0, -10.0, -5.0, 0.0, 5.0, 10.0, 15.0, 20.0, 40.0,**	**0.0 Kn**	**Select test value of longitudinal speed**	
4	**TRANSV. SP**	**-5.0, -4.0, -2.0, -1.0, -0.5, 0.0,**	**0.0 Kn**	**Select test value of transversal speed**	

		0.5, 1.0, 2.0, 4.0, 5.0,			
5	**DISTANCE**	**0.00, 9.99, 99.99, 999.99, 9999.99, 99999.99**	**0.00 NM**	**Select test value of distance.**	
6				**Not used**	

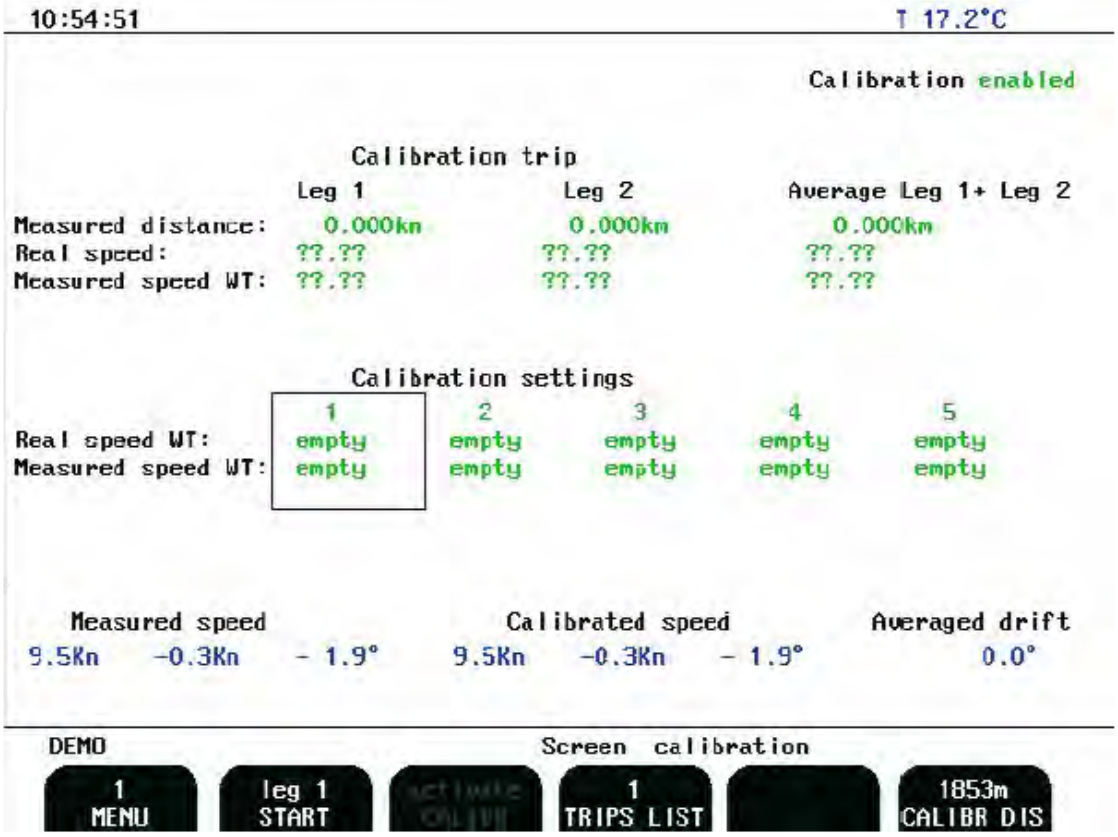


Fig. 3.13. Screen Calibration, Menu 1

Softkey	Name	Range/value	Default value	Description	Activate
1	MENU			**Chosen menu number 1.**	
2	**START**	**Leg 1 start/finish Leg 2 start/finish**	**Leg 1**	**Used to start/finish test trip.**	**Yes**
3	**CALIBR**			**Used to move data, collected during test trip into calibration table.**	
4	**TRIPS**	**1 - 5**	**1**	**Used to list between different**	

	LIST			**test trip data sets. Only one test trip is displayed on the screen at a time.**	
5				**Not used**	
6	**CALIBR DIS**	**100 - 10000**	**1853 m**	**Used to adjust length of the test leg.**	

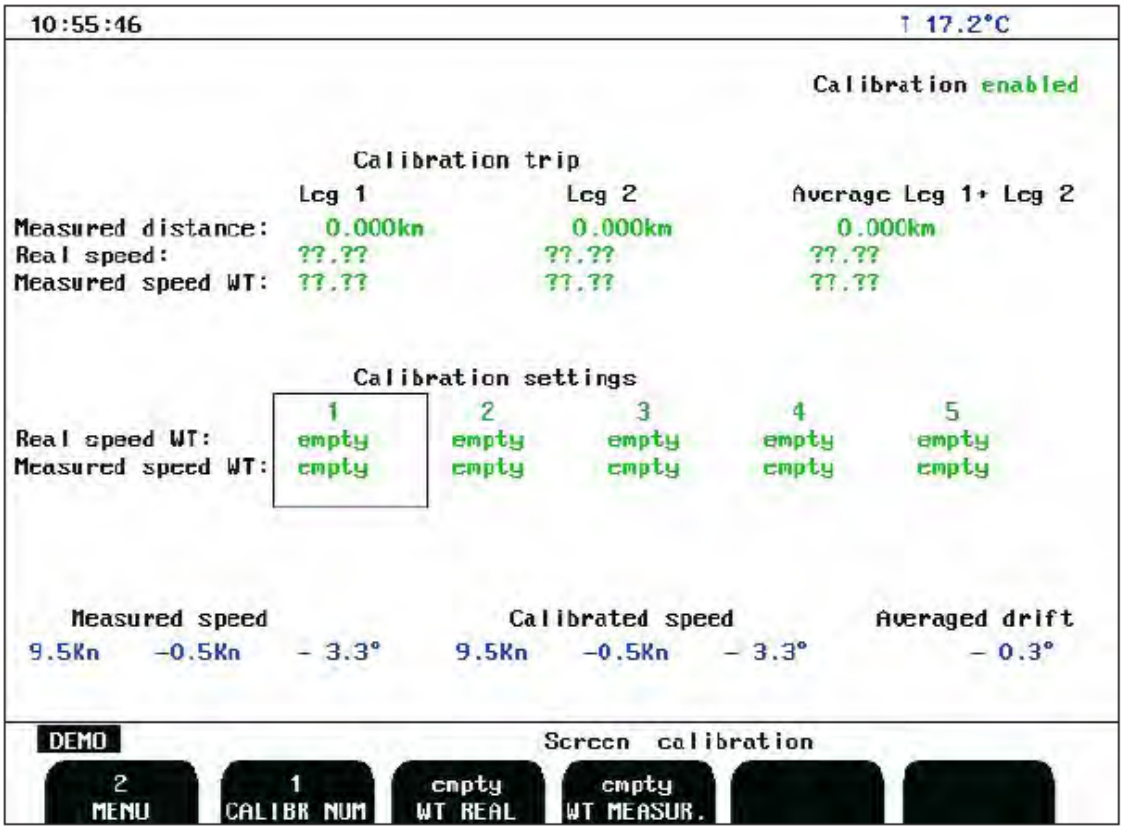


Fig. 3.14. Screen Calibration, Menu 2

Softkey	Name	Range/value	Default value	Description
1	MENU	**1 - 3**	2	**Chosen menu number 2.**
2	**CALIBR NUM**	**1 - 5** \	**1**	**Number of the calibration, currently available for adjustments. In the calibration table it is marked by the frame.**

3	**WT REAL**	**Empty, 0.0 - 38.9**	**Empty**	**Real ship's WT speed.**
4	**WT MEASUR**	**Empty, 0.0 - 38.9**	**Empty**	**WT speed, measured by the system (not calibrated).**
5				**Not used**
6				**Not used**

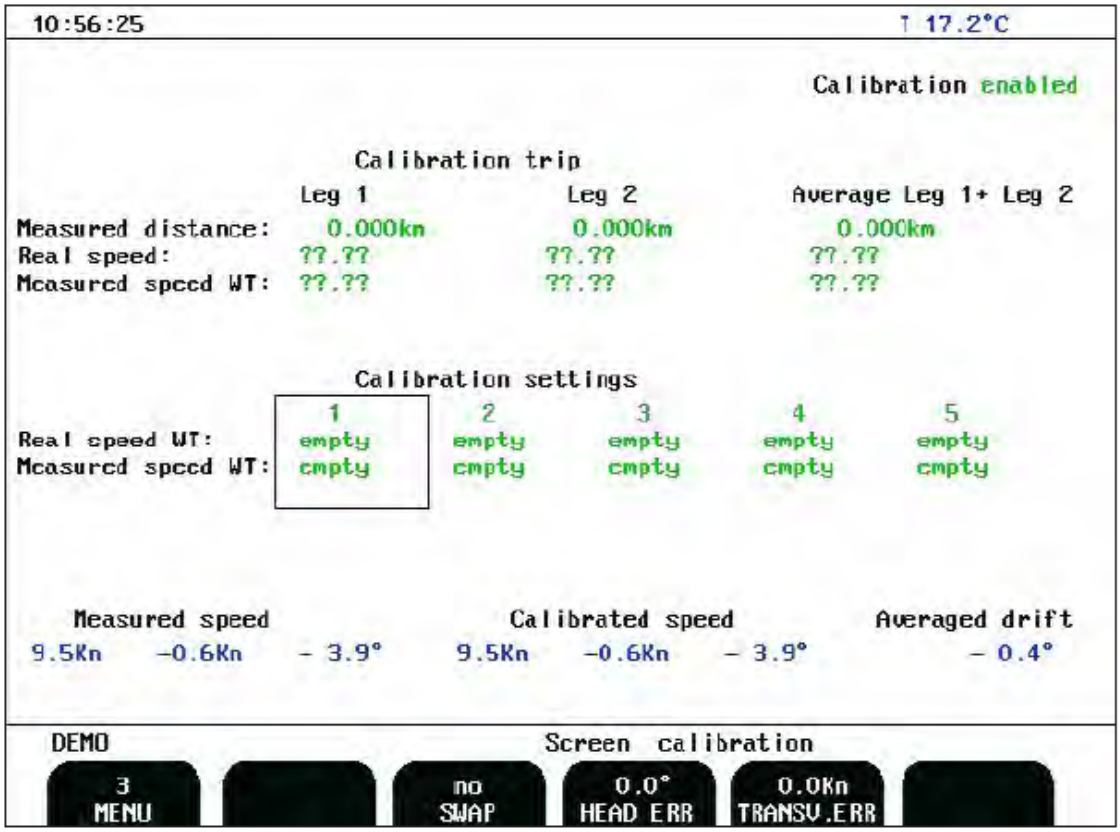


Fig.3.15. Screen Calibration, Menu 3

Softkey	Name	Range/value	Default value	Description
1	MENU	**1 - 3**	3	**Chosen menu number 3.**
2				**Not used**
3	**SWAP**	**No, p-s, f-a, p-s/f-a,**	**No**	**Sensor elements swap.**
4	**HEAD ERR**	**0.0 - 30.0**	**0.0 °**	**Installation angular error correction.**
5	**TRANSV.**	**0.0 - 38.9**	**0.0 Kn**	**Installation transversal error**

	ERR			**correction.**
6				**Not used**

Principal Functions

Principles of Electromagnetic Log

The sensor of the electromagnetic log creates a magnetic field in the water. When the ship moves, the stream of water running along the hull cuts this magnetic field and generates a difference in potential between the sensor electrodes. This difference is directly proportional to the speed of the stream of water. Calibration of the log makes it possible to correct the difference between the water speed around the transducer and the speed of the ship. These differences being essentially linked to the positioning of the transducer in relation to the hull and also to the hull's shape.

Power ON/OFF

During normal daily operation, the system may be switched off from all operation menus. This operation does not disconnect the system from the power supply, but all power consuming components are switched off. The system may be switched on again by pressing any button.

Alarm acknowledgement

When any alarm is activated, the alarm may be acknowledged by pressing any button. An alarm can also be silenced by using a remote alarm button, but the alarm message will still be present until a button is pressed on the operator unit.

Fixed Key Functions

Screen Select

The SCREEN SELECT button facilitates selection of one of the five screen and softkey layouts. The 2 primary operation screens may be cycled by repeatedly pressing the SCREEN SELECT button. Access to the remaining screens is through encoder operation. The screens are cycled in an endless, bidirectional loop, e.g.

turning the encoder counter-clockwise, will open the last screen after the first screen. Turning the encoder with no buttons pressed always force screen A.

Backlight adjustment

Backlight may be continuously controlled by using the appropriate button and the encoder. Press the button and rotate the encoder until a satisfactory setting is obtained, then release the button. The settings are maintained in the nonvolatile memory, and the last settings are restored on power up. Backlight may be adjusted in both day and night vision.

Day/Night

Day/Night vision may be selected by pressing this button.

Key Functions

Menu

On som screens, the leftmost softkey is used for selecting the desired menu, i.e. softkey layout within a screen. The different screens have a different number of menus, and some of the menu functions may be available on more than one menu. Below is a list of all menu functions, not necessarily in the sequence they appear on the screens.

Trip Reset

This key is used to reset the trip distance counter.

Alarm Settings

Speed alarm settings are performed from status screen, menu 1. Alarm limits are referred to the indicated speed and depth. The local alarm buzzer may be disabled from status screen, menu 1, but the external alarm relay will always operate. The only way to disable the alarms completely, is to reduce the low speed alarm to zero and increase the high speed alarm to maximum range. An active low speed alarm must be less than an active high speed alarm. Alarm limits are enforced with hysteresis.

Clock and Calendar Settings

Manual clock and calendar adjustments are carried out in the status screen menu 3. If a satellite navigator giving UTC messages is connected to the NMEA input, the clock and calendar will be automatically updated and manual adjustment is not required.

Simulator

The EML224 contains a built in simulator to test the screen indicators and various interface signals. The simulator may be switched on and off on status screen menu 1. When the simulator is operating, “Demo” is flashing at the bottom of the screen.

Status Screen

The Status Screen shows a list of various system parameters useful for documenting system set-up and system operating status. The contents of this screen will be valuable information in situations where manufacturer support is required.

Nonvolatile Parameter Memory

The system contains memory to maintain installation and user parameters like language and units of measurement selection, backlight settings, etc. These parameters are automatically restored on power up. If the user parameters have never been set, default values are used.

Options

Repeaters/speed and distance

Digital repeaters may be connected to the system.

1.4 Maintenance

Sensor Maintenance

The sensor is virtually maintenance free, but occasional cleaning may be necessary depending on sea water conditions.

Operator Unit Maintenance

The operator unit contains no user serviceable parts, and requires no maintenance apart from occasional cleaning of the front panel. Please use a soft cloth and no chemicals except cleaning alcohol.

2 DS80

2.1 System overview

The FURUNO DS-80 displays ship's speedrelative to water, using the Doppler principle; ship's speed is measured by detecting the Doppler shift frequency from the signal returned from the watermass.

The output is interfaced with ARPA, AIS, and other shipborne equipment in IEC 61162-1 format.

The main features of the DS-80 are:

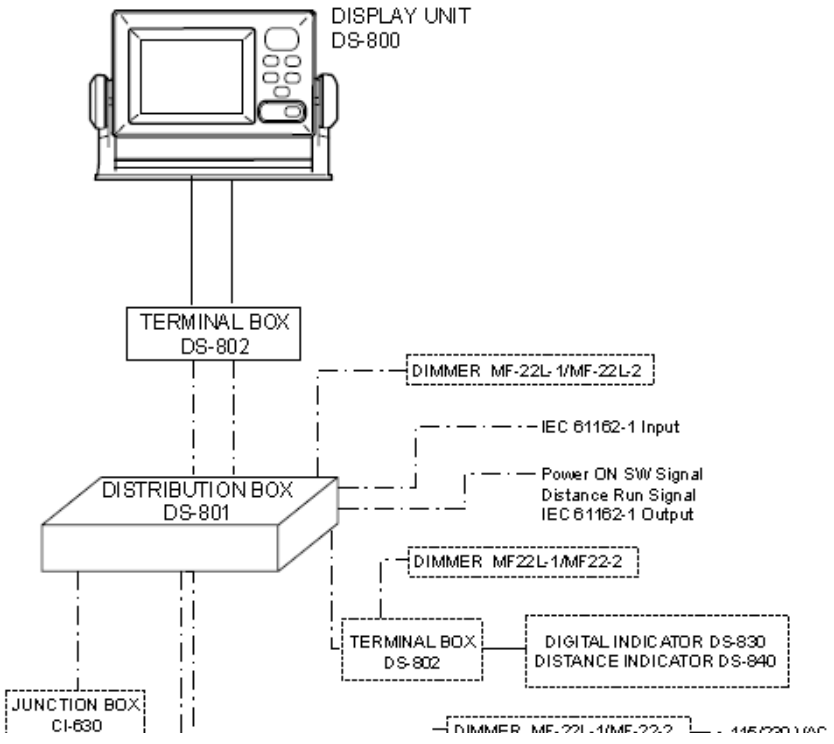
 Simple operation. In most cases all thatis required to display ship's speed is to turn on the equipment.

 Pair-beam system effectively reduces error caused by pitching. The transducer assembly symmetrically emits two sonic beams, one fore and the other aft. By averaging the Doppler shift in both directions accurate speed data is available under rough sea conditions.

 Speed and distance information on the adjustable-contrast LCD display.

 Analog display, digital Indicator and digital distance indicator display optionally available.

 Conforms to the following standards: IMO A.824(19), as amended by MSC.97(72), IMO A.694(17), IEC 61023, IEC 60945 (3rd edition), IEC 61162-1 (2nd edition).

The 

which is

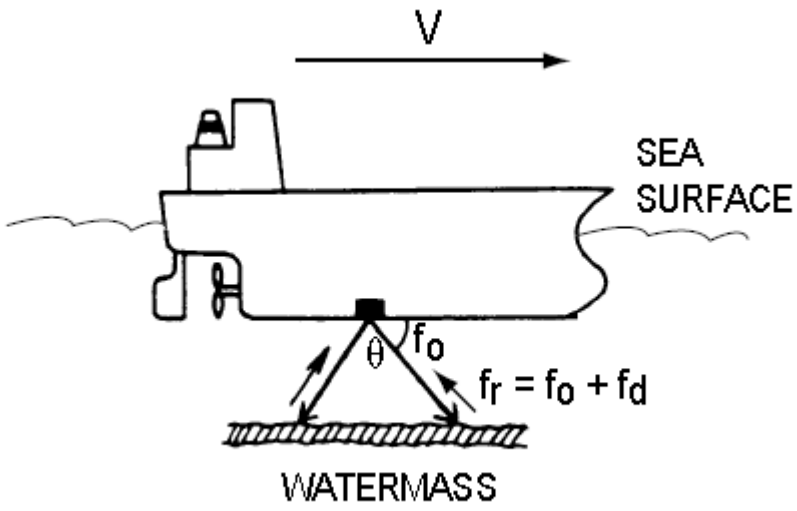
observed as a frequency shift resulting from relative motion between a transmitter and receiver or reflector of acoustic or electromagnetic energy. A common example of the Doppler Effect is a train. When a train is approaching, the whistle has a higher pitch than normal. You can hear the change in pitch as the train passes.

The DS-80 has a pair-beam, one directed in the fore direction and the other in the aft direction, which emits ultrasonic waves at an angle of è to the waterline towards ship's fore and aft directions. The frequency of the received signal is then compared with that of the transmitted frequency to measure doppler shift to calculate ship's speed.

The relative motion causes the Doppler shift and the ultrasonic waves reflected at the watermass (plankton or any underwater objects) are received at the frequency of fr = fo + fd where fd is the number of frequency shifts counted at the receiver circuit. To calculate ship's speed, the following formula is used.

V = fd/fo • c/2sinèc: Underwater velocity

Note that the sound velocity in water changes with water temperature and water pressure but the DS-80 readout is automatically compensated for change by using a temperature sensor.



2.2 Technical data

GENERAL

(1) Speed Range Fore-Aft: -10.0 to +40 knots through-the-water

(2) Distance Run 0.00 to 999,999.99 nautical miles through-the-water

(3) Working Depth Water depth greater than 3 m beneath the keel.

(4) Working Frequency 1.0 MHz

(5) Speed Accuracy 1.0% or 0.1 knots whichever is the greater

(6) Distance Accuracy 1.0% or 0.1 nm whichever is the greater

Note: Accuracy is subject to shallow water effects, to the effect of wind, current and tide, and

sensor location. Any ultrasonic equipment having the same frequency may interfere with speed measurement. The Doppler Log transducer should be installed apart from the transducers of such kind of equipment.

DISPLAY UNIT

(1) Display Character size 15 or 21 mm H on monochrome LCD

(2) Indication Ship's speed

Fore: ▲**.* knots (+40.0 kt max.)

Aft: ▼**.* knots (-10.0 kt max.)

Distance run ******.** nm

(3) Other Function Diagnostic check

DIGITAL INTERFACE

(1) Serial Signal

Output: 2 ports; VBW, VLW in IEC 61162-1 (NMEA 0183 Ver 2.0)

Input: 1 port; IEC 61162 (NMEA 0183 Ver 2.0)

(2) Analog Signal Speed signal for Analog display: 2 port

-3.3 mA to 10 mA/ -10 kt to +30 kt

Analog current output: 1 port

4 mA to 20 mA/ -10 kt to 30 kt

Analog voltage output: 1 port

-3.3 V to 10 V/ -10 kt to 30 kt

(3) Distance run output 2 ports; Contact closure each 0.005 nm, forward speed,

30 VDC: 0.4 A

(4) System Check signal 1 port, 30 VDC: 0.2 A, default: closed

POWER SUPPLY

(1) System Source 100/110/115/200/220/230 VAC:1.5/0.7 A max., 1 phase, 50-60 Hz

ENVIRONMENTAL CONDITION (IEC 60945)

(1) Ambient Temperature -15°C to +55°C (units for protected area)

Analog display: 0°C to +50°C

(2) Relative Humidity 95% at 40°C

(3) Vibration IEC 60945 adopted

(4) Category of Equipment

Display Unit/Distance indicator/Transceiver Unit:

For protected area

Transducer: For submerged use, 600 kPa x 12 h

Distributor/Terminal box: For protected area

COATING COLOR

(1) Display Unit Cover: Munsell 2.5GY5/1.5 (light gray), Panel: N3.0 (gray)

(2) Distribution Box Munsell 2.5GY5/1.5 (light gray)

(3) Transceiver Unit Munsell 2.5GY5/1.5 (light gray)

(4) Terminal Box Munsell 2.5GY5/1.5 (light gray)

(5) Analog Display Munsell 2.5GY5/1.5 (light gray)

COMPASS SAFE DISTANCE

(1) Display Unit/Digital Indicator/Digital Distance Indicator

Standard: 0.50 m, Steering: 0.40 m

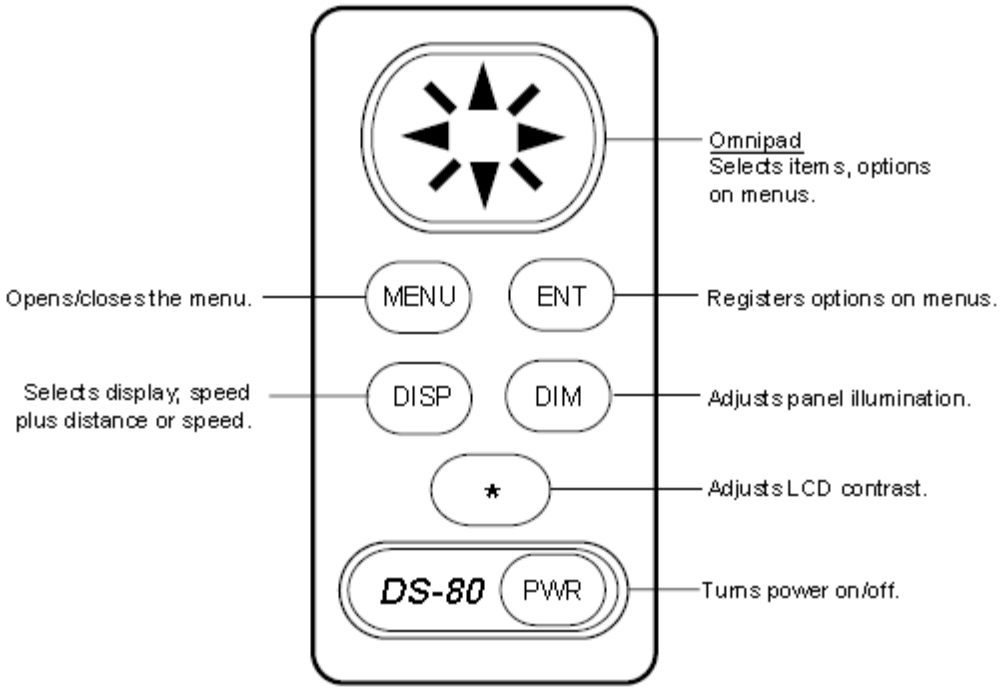
(2) Transceiver Unit Standard: 2.05 m, Steering: 1.40 m

(3) Distribution Box Standard: 3.10 m, Steering: 2.10 m

(4) Terminal Box Standard: 0.65 m, Steering: 0.45 m

2.3 Operation

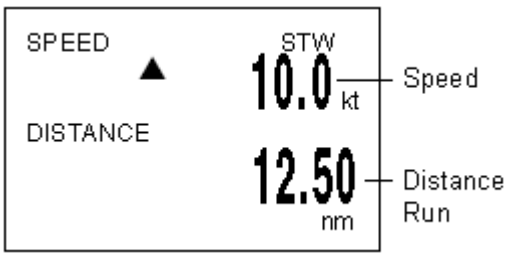
2.3.1 Controls



2.3.2 Turning the Power On/Off

2.3.2.1 Power on

Press the [POWER] switch to turn on the equipment. The last-used display appears. The example below shows the speed and distance run.



Note: STW means Speed Through Water. This indication flashes when transducer temperature, which can be monitored on the TEST display (see page 16), is abnormal. This means speed accuracy is less than stated in the specifications.

2.3.2.2 Power off

Press the [POWER] switch to turn the power off.

Note: Keep the DS-80 energized continuously unless it fails. Turning off the DS-80 may cause an inconvenience in associated equipment, such as a radar.

2.3.3 Adjusting Contrast, Panel

2.3.3.1 Contrast

1. Press the [*] key to open the contrast adjustment dialog box.

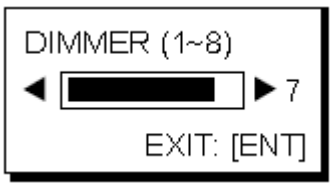
2. Press the Omnipad at or to adjust the contrast. The setting range is 0 to 63 and the default setting is 48.

3. Press the [ENT] key.

Note: The contrast is automatically set to default (48) when the power is turned on.

3.3.2 Panel dimmer

1. Press the [DIM] key to show the dimmer adjustment dialog box.



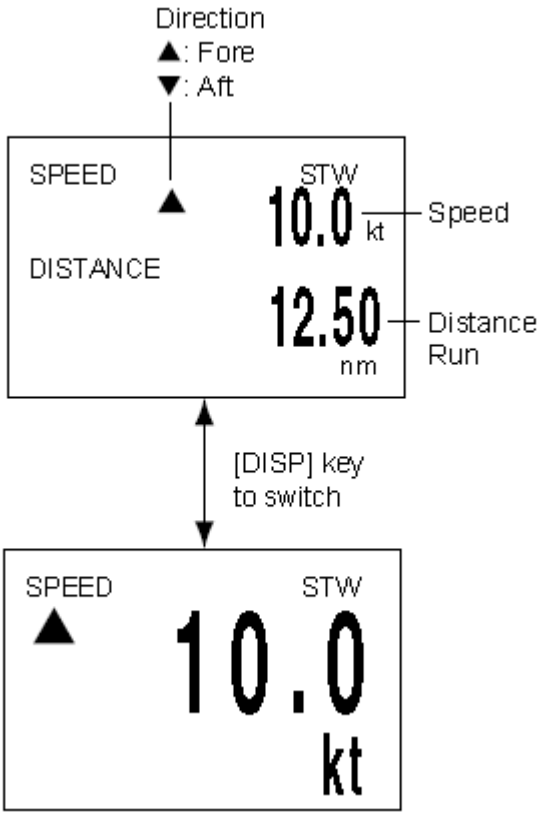
2. Press the Omnipad at ◀ or ▶ to adjust the dimmer. The setting range is 1 to 8 and the default setting is 4.

3. Press the [ENT] key to conclude.

Note: The [DIM] key is inoperative when dimmer is controlled externally.

3.4 Selecting a Display

Press the [DISP] key to select display desired. Each time the key is pressed the display shows speed and distance run or speed alone as below.



□ Arrow indicates direction: ◀ indicatesfore; ▶ , aft.

□ The distance run indication shows the total distance run in forward speed only.

□ The distance run is backed up when the power is turned off.

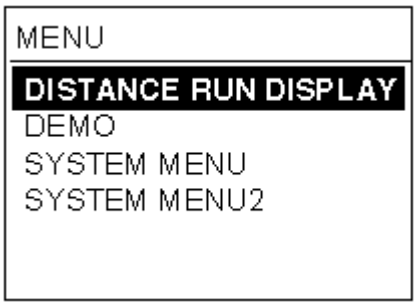
Note: Speed error may occur in rough seas because of air bubbles, etc.

When speed error occurs, the speed indication freezes, and “KT” is highlighted and blinks. If speed error continues more than 30 seconds, the speed indication changes to **.*.

2.3.5 Main Menu Operation

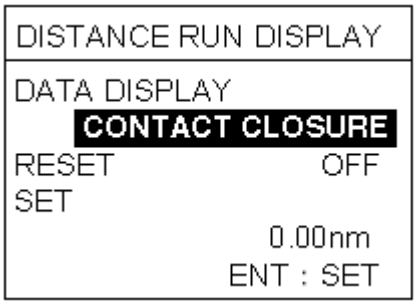
Functions of the DS-80 are selected through the menu.

1. Press the [MENU] key to open the menu.

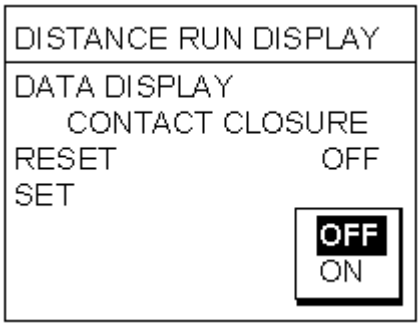


2. Press the Omnipad at ▲ or ▼ to select a menu item (current selection is highlighted) and press the [ENT] key.

For example, when DISTANCE RUN DISPLAY is selected the following display appears. Distance run is a form of contact closure, 200 pulses/nm. To select IEC 61162 sentence, see paragraph 3.6.1.



3. Press the Omnipad at ▲ or ▼ to select the menu item desired and press the [ENT] key. For example select RESET.



4. Press the Omnipad at ▲ or ▼ to select the menu option desired and press the [ENT] key.

5. Press the [MENU] key twice to close the menu. (Some menus require only a single pressing of the [MENU] key.)

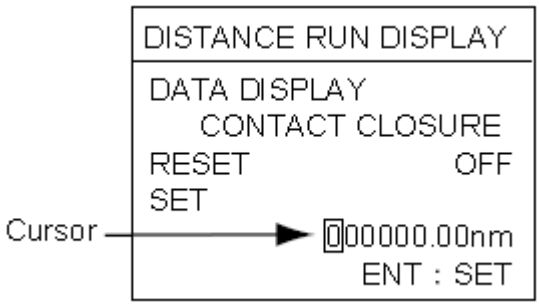
To enter numerical data

Some menus require input of numeric data.

This is done with the Omnipad.

1. Select the digit or sign (+ or -) to change with ◀ or ▶ on the Omnipad. (The cursor shows the digit or sign selected.)

2. Enter a figure at each digit by hitting the Omnipad at ▲ or ▼ The example below shows the DISTANCE RUN DISPLAY menu, where you may adjust the distance run indication for SET.



3. Press the [ENT] key to conclude.

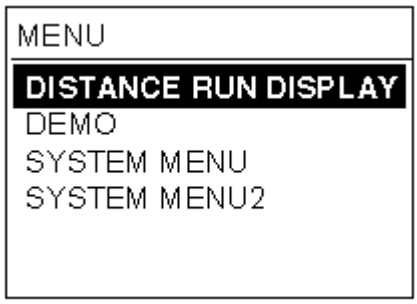
2.3.6 Distance Run Operation

The operator may adjust and reset the distance run indication and select display method.

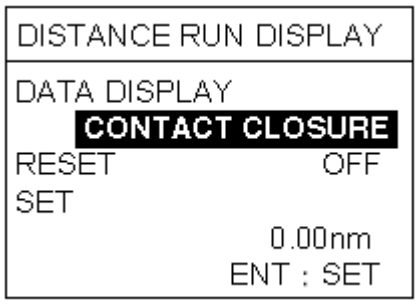
2.3.6.1 Selecting display method

The default setting provides for independent display and adjustment of the distance run indication on all displays (display unit, Digital Indicator, distance indicator).
To show the same distance run indication on all displays do the following:

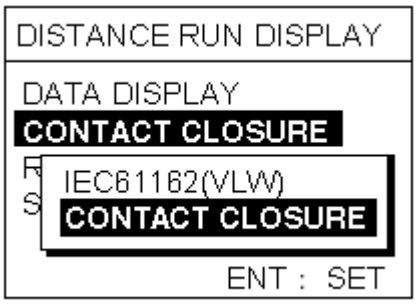
1. Press the [MENU] key to open the menu.



2. Press the Omnipad at ▲ to select DISTANCE RUN DISPLAY and pressthe [ENT] key.



3. Select DATA DISPLAY and press the [ENT] key.



4. Press▲ to select IEC 61162(VLW) and press the [ENT] key.

5. Press the [MENU] key twice to close the menu.

2.3.6.2 Adjusting distance run

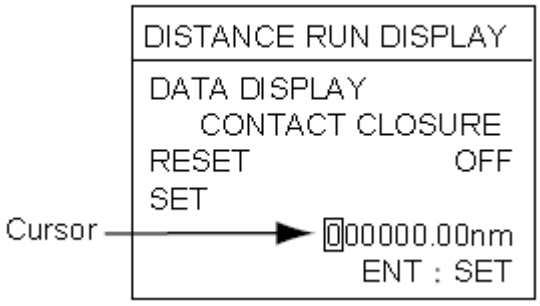
Distance run can be changed when the menu item DATA DISPLAY is selected to CONTACT CLOSURE. It may also be changed only at the display unit when IEC 61162(VLW) is selected. .

1. Press the [MENU] key to open the menu.

2. Use▲ to select DISTANCE RUN DISPLAY and press the [ENT] key.

3. Select SET and press the [ENT] key.

The cursor circumscribes the leftmost digit of the distance run figure.



4. Press the Omnipad at ◀or▶ to select the digit to change.

5. Press the Omnipad at ▲ or ▼ to change value. The setting range is 0.00 nm to 999999.99 nm.

6. Press the [ENT] key followed by pressing the [MENU] key twice to conclude your selection and close the menu.

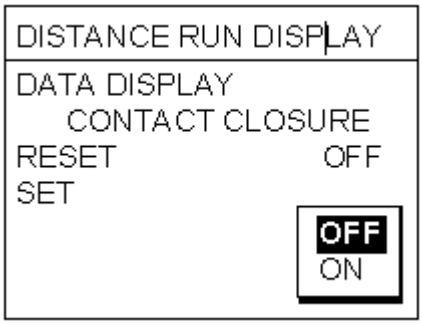
2.3.6.3 Resetting distance run to zero

Distance run can be reset to zero when the menu item DATA DISPLAY is selected to CONTACT CLOSURE. It may also be reset to zero only at the display unit when IEC 61162(VLW) is selected.

1. Press the [MENU] key to open the menu.

2. Press the Omnipad at ▼ to select DISTANCE RUN DISPLAY and press the [ENT] key.

3. Select RESET and press the [ENT] key.



4. Press the Omnipad at ▼ to select ON.

5. Press the [ENT] key to finish and press the [MENU] key twice to close the menu. The distance run indication reads 0.00.

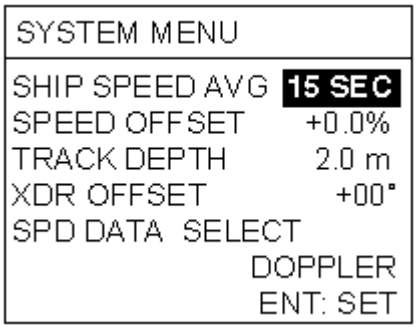
2.3.7 System Setting

The system setting provides the fundamental parameters for intended performance of the DS-80.

2.3.7.1 Displaying the system menu

1. Press the [MENU] key to open the menu.

2. Select SYSTEM MENU and press the [ENT] key.



2.3.7.2 Ship speed average

Wind and currents affect ship's speed, and speed data is averaged over the time period set on this menu. Increase the speed averaging period if the speed reading is unstable.

1. Open the SYSTEM MENU.
2. Select SHIP SPEED AVG and press the [ENT] key.

3. Select averaging time period desired among 15, 30, 45 and 60 seconds.
4. Press the [ENT] key.
5. Press the [MENU] key twice to close the menu.

2.3.7.3 Speed offset (calibration)

Calibration of any speed log is necessary through the sea trials during the commissioning tests. Fill in the calibration sheet which is on page 25 of this manual. Us the resultant data to calculate speed offset and enter it as below. The setting range is -25.0% to +25.0%.

1. Open the SYSTEM MENU.
2. Select SPEED OFFSET and press the [ENT] key.

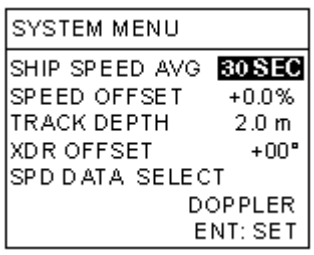
SYSTEM MENU
SHIP SPEED AVG 30 SEC SPEED OFFSET 00.0% TRACK DEPTH 2.0 m XDR OFFSET +00° SPD DATA SELECT DOPPLE R ENT: SET

3. Select the digit to change with 4 or ► and change the value with ▲ or ▼ on the Omnipad.
4. Press the [ENT] key.
5. Press the [MENU] key twice to close the menu.

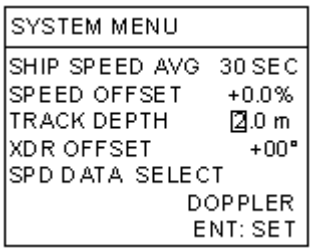
2.3.7.4 Tracking depth

Doppler shift measuring depth in the DS-80 is 2 m at default. If the speed readout is unstable due to air bubbles near the ship's hull, increase or decrease the track depth to stabilize the readout. The setting range is 1.0 m to 9.9 m.

1. Open the SYSTEM MENU.



2. Select TRACK DEPTH and press the [ENT] key.



3. Select the digit to change 4 or ► and change the value with ▲ or ▼ on the Omnipad.
4. Press the [ENT] key.
5. Press the [MENU] key twice to close the menu.

2.3.7.5 Transducer offset

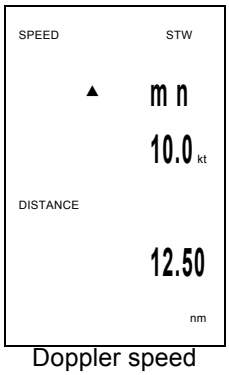
Sets the deviation angle of the transducer's orientation with reference to the ship's longitudinal axis. This is done at installation; no user adjustment is necessary.

2.3.7.6 Speed data selection

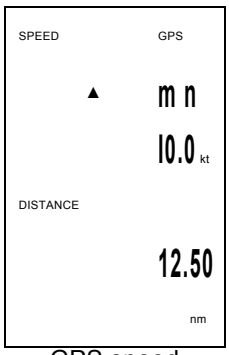
When the DS-80 fails to work as an SDME, the display unit can be used as a monitor display tool for a GPS speed or other equipment measuring the ship's speed.

1. Open the SYSTEM MENU.
2. Select SPD DATA SELECT and press the [ENT] key.

3. Select the option GPS and press the [ENT] key.
4. Press the [MENU] key twice to close the menu. See the illustration below for speed display information. If the speed displayed is unstable perform the check described in paragraph 3.2.



Doppler speed



GPS speed

"AUTO" position indicates a Doppler speed (SDME) but if the DS-80 fails, a GPS speed will be indicated.

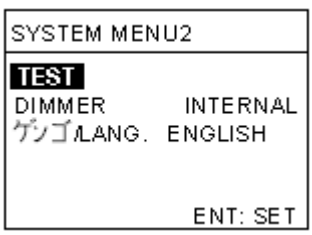
Note 1: If the log speed fails, the display unit reads a GPS speed, but speed data will not be output to other equipment.

Note 2: Doppler speed is used to calculate speed when both DOPPLER and GPS are abnormal in AUTO.

2.3.7.7 System menu 2

The System Menu 2 contains the diagnostic test and selection of dimmer control and display language.

1. Press the [MENU] key to open the menu.
2. Select SYSTEM MENU 2 and press the [ENT] key.



TEST: Checks the equipment for proper operation. For further details see Chapter 3.

DIMMER: See paragraph 1.3.2.

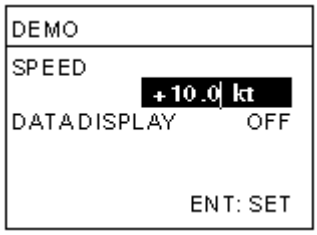
LANG.: Selects the language to use in menus, English or Japanese.

2.3.8 Demonstration Mode

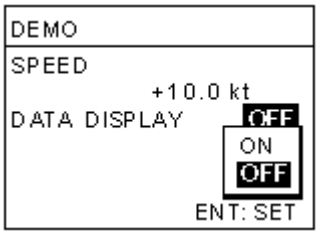
The demonstration mode outputs the Doppler speed signal to external equipment.

This checks if the signal is being correctly output.)

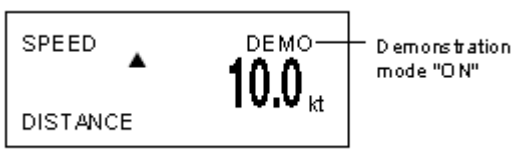
1. Press the [MENU] key to open the menu.
2. Select DEMO and press the [ENT] key.



3. Select SPEED and press the [ENT] key.
4. Select the digit to change with or .
5. Use or to set. (The setting range is -10.0 to +40.0 kt, and the default setting is +10.0 kt.)
6. Press the [ENT] key.
7. Press the [ENT] key to open the DATA DISPLAY menu.



8. Press to select ON and press the [ENT] key.
9. Press the [MENU] key twice to close the menu. The indication “DEMO” appears at the top right-hand corner when the demo mode is on. To turn off the demonstration display, show the DEMO menu and set SPD to OFF.



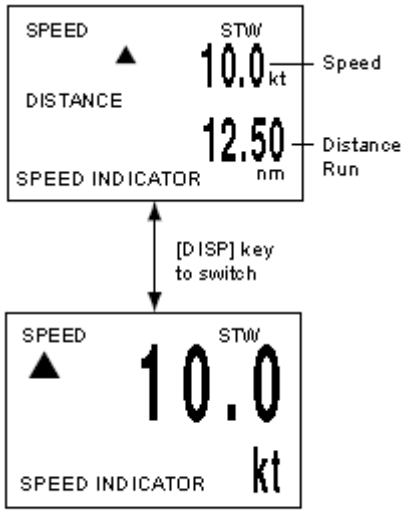
2.3.9 OPERATION OF OPTIONAL EQUIPMENT

The Digital Indicator DS-830 and Distance Indicator DS-840 have the same controls as the display unit. This chapter explains the features which are not shared with the display unit.

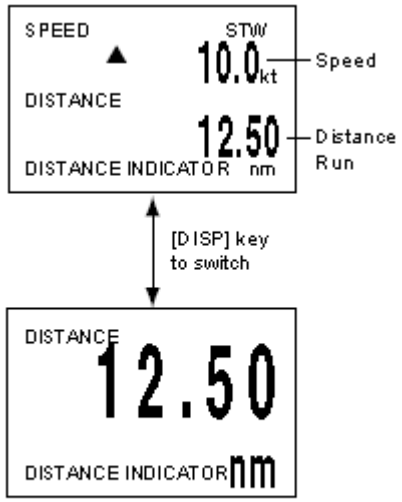
Digital Indicator DS-830,Distance Indicator DS-840

Selecting a display

Press the [DISP] key to select the display mode. Each time the key is pressed the display shows speed plus distance run or speed alone as below.



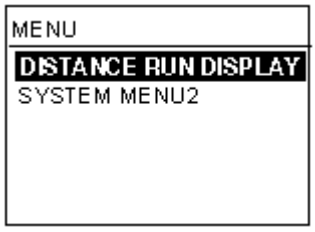
Digital Indicator DS-830



Distance Indicator DS-840

Menu operation

1. Press the [MENU] key to show the display below.



2. For details refer to the following:

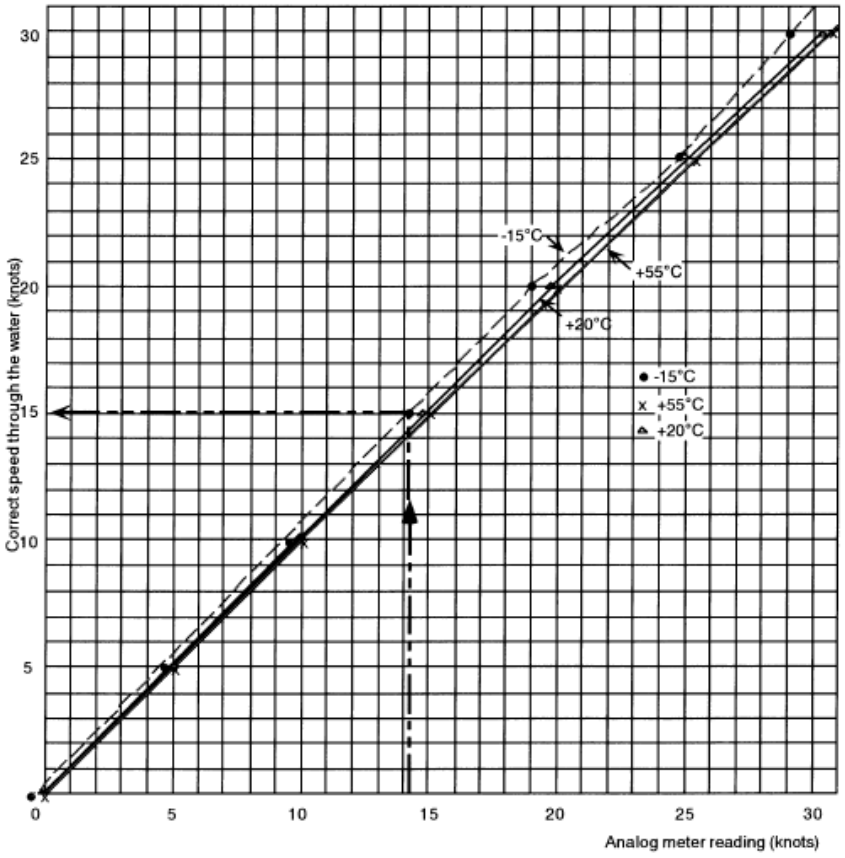
DISTANCE RUN DISPLAY: See paragraph 1.6.

SYSTEM MENU 2: See 1.7.7 System Menu 2.

Adjusting dimmer and contrast

See paragraph 1.3.

ANALOG DISPLAY UNIT
CORRECTION DIAGRAM AT EXTREME TEMPERATURES



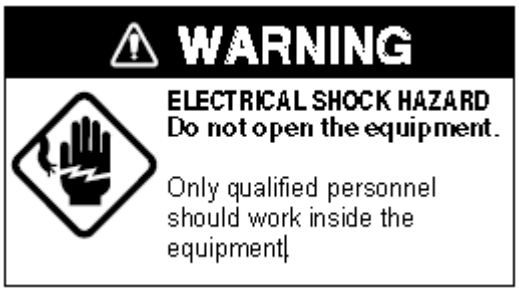
Doppler Speed Log DS-80
CORRECTION FACTOR FOR ANALOG DISPLAY MF-22A-1

Example:

If the analog speedometer reads 14.2 kt at a temperature of –15°C, the correct speed through the water is 15 kt. Failure of correction in low temperature can result in a maximum error of –0.8 kt or 5.3% for 14.2 kt readout. IMO limit of ±2% is exceeded over 10.0 – 30.0 kt reading but correction by this graph brings a correct measurement. At +55°C, an error of +0.0 kt (+2.7%) occurs at a speed of 30 kt; no other point IMO limit of ±2% is exceeded.

When the digital display and analog display readouts are different, take precedence of the digital readout. At temperatures 0°C to 50°C, the speedometer never exceeds the IMO limits.

2.4 Maintenance



Preventive maintenance

Check the following points regularly to maintain performance.

 Check that the connectors on all units of the system are firmly fastened and free of rust. Clean if soiled or corroded.

 Check that all ground wires are tightly fastened.

 Dust and dirt on the display unit including the screen may be removed with a soft cloth. Do not use chemical cleaners to clean the display unit; they can remove paint and markings.

Transducer maintenance

Marine life (barnacles, etc.) adhering to the transducer face will reduce sensitivity. Periodically remove any marine life from the transducer face with fine sandpaper or a piece of wood.

CAUTION

Do not paint the transducer.

Painting will affect performance.

Fuse replacement

Fuses in the units of the system protect the electrical circuitry from burning by overcurrent. If the equipment cannot be energized check the fuse in the power cable connected to the display unit. Locate the cause before replacing the fuse.

Unit	Rating, Qty	Type, Code No.	Location
Display Unit	1A, 2 pcs.	FGMB1A 125 VAC, 000-114-805	Fuse holder in power cable
Distribution Box	3A, 2 pcs.	FGBO 3A 250 VAC 000-549021	Inside unit
Transceiver Unit	1A, 2 pcs.	FGBO 1A 250 VAC, 000-549019	

⚠ CAUTION

Use the proper fuse.

Use of a wrong fuse can cause fire or equipment damage and void the warranty.

Troubleshooting

This section provides troubleshooting procedures. Advanced level troubleshooting should be done by referring to the Service Manual (optional supply).

Problem	Probable cause	Remedy
General		

Cannot turn on the power.	Loosened power cable	Fasten the power cable.
	Blown fuse	Replace the fuse.
Power is on but nothing appears on the screen.	Contrast too low.	Press the [*] key several times.
Doppler speed indication		
speed STW ^ A 10,0 ■£] DISTANCE \ 12,50 nm	'Last correct speed is displayed (display freezes). ^Reverse video and blinking	Ship's speed cannot be calculated because of air bubbles, etc. (Speed error : 30 seconds)
SPEED STW A ** DISTANCE kt 12,50 nm	— Speed shown as "***".	• Problem with the transducer or air bubbles. • Speed error continues more than 30 seconds.
SPEED STW a m DISTANCE 12,50 nm	STW flashing	• Temperature sensor is abnormal.
GPS speed indication		
SPEED GPS ** *- DISTANCE kt 12,50 nm	-Speed indication shown as "***".	GPS data error.
SPEED -------- DISTANCE kt 12,50 nm	_"GPS" is replaced with "-—".	• No GPS data for 30 seconds. • GPS receiver disconnected.

If any abnormal speed indication continues contact your dealer for advice.

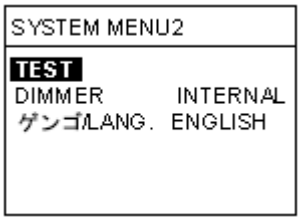
Diagnostics, Checking

Program Number

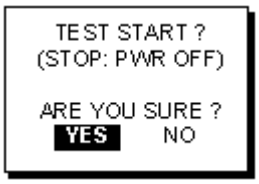
The diagnostic facility checks the ROM, RAM, SIO and displays program ID.

1. Press the [MENU] key to open the menu.

2. Select SYSTEM MENU2 and press the [ENT] key.



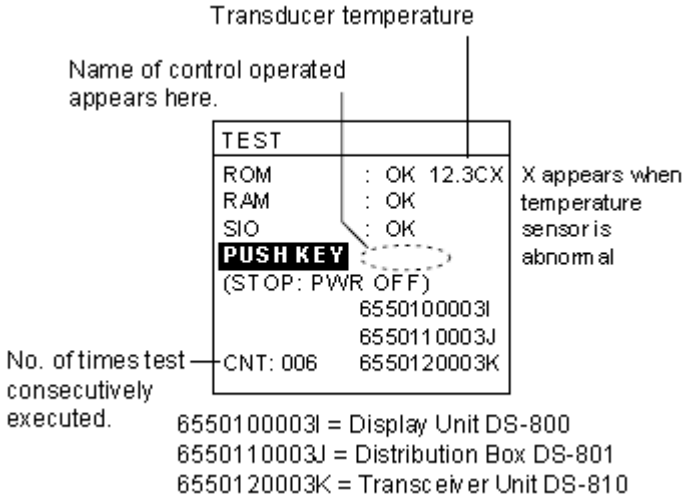
3. Press the [ENT] key. The following display appears.



4. Press the [ENT] key to start the test. In a few moments the display should changes as shown at the top of the adjacent column.

The ROM, RAM and SIO (if special connector is used) are checked for proper operation and the results shown as OK or NG (No Good). For NG, contact your dealer for advice.

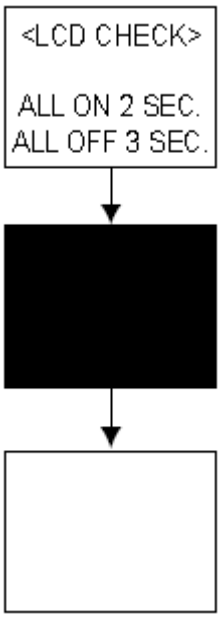
The program number also appears here. “PUSH KEY” is highlighted, prompting you to check the controls. Operate any control (except the [POWER] switch) within five seconds. The name of the activated control appears on screen if it is operating normally. Note that if no control is operated within five seconds, the equipment automatically begins checking the LCD.



Control operated and indication

Control	Indication
▲	UP
▼	DOWN
◀	LEFT
▶	RIGHT
MENU	MENU
ENT	ENT
DISP	DISP
DIM	DIM
*	*

5. The equipment automatically checks the LCD, displaying the following in order.



6. The test repeats itself. To stop the test, turn the power switch off and on again.